FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World
Founder and Editor: STANLEY SPOONER
A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport
OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 580 (No. 6, Vol. XII.) FEBRUARY 5, 1920 [Weekly, Price 6d. Post Free, 7d.

Flight
The Aircraft Engineer and Airships
Editorial Office: 36, GREAT QUEEN STREET, KINGSWAY, W.C. 2.
Telegrams: Truditur, Westcent, London. Telephone: Gerrard 1828.
Annual Subscription Rates, Post Free:
United Kingdom .. 28s. 2d. Abroad.. .. .. 33s. 0d.*
These rates are subject to any alteration found necessary under abnormal conditions
* *European subscriptions must be remitted in British currency*

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DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the date of important fixtures are invited to send particulars for inclusion in the following list:—

Feb. 28 ...	Lecture by Mr. Handley Page, C.B.E., at King's College, Strand, at 11 p.m.
April 18 to May 2	Seaplane Competition at Monaco
May 22 and 23	Aviation Competition at Juvisy in connection with Fêtes de Paris
June 1 ...	Air Ministry Competition (Small Type Aeroplanes), Martlesham Heath
July ...	S.B.A.C. International Aero Exhibition at Olympia
July (mid.)	Seaplane Contests at Antwerp
Aug. 1 ...	Air Ministry Competition (Seaplanes) Felixstowe
Aug. (end of)	Schneider International Race, Venice.
Sept. 1 ...	Air Ministry Competition (Large Type Aeroplanes), Martlesham Heath
Sept. (end of)	Gordon-Bennett Aviation Cup, France.

EDITORIAL COMMENT

The London–Cape Flight

WHEN the Air Ministry first announced the survey of the Cairo-Cape air route, all who are interested in the future of aviation naturally began to wonder who would be the first to attempt to put to a practical test the route explored and surveyed in spite of so many obstacles, and in some instances with the greatest difficulty. The task is one of such a magnitude that its organisation could only be undertaken by very wealthy firms or individuals, and in the circumstances it would have been natural if the feat had been made a National, or Imperial, undertaking. It is very certain, as we have so often pointed out in these columns, that the future of the British Empire will depend largely upon our strength in the air, while no better aid could be given to the knitting together of our far-flung Empire than rapid communication between its individual parts. For Imperial reasons, therefore, we could have wished that the Government had undertaken the first Cairo-Cape flight, but again it has been left to private enterprise to come forward and, so to speak, fight the Government's battles. And, also again, it has been left to Lord Northcliffe personally to step in and suggest the undertaking of the flight. Much as Lord Northcliffe has already done for the development of aviation, this latest magnificent assistance which he has given by putting forward the suggestion that *The Times* should arrange for a flight from Cairo to Cape Town will go far to surpass in immediate practical utility any of his previous generous gifts. The flight is, it should be remembered, not a race but a flight of exploration, and as such may well have the greatest influence upon the future development of civil aviation.

Of the dangers of the trip, and of the romantic element in which it abounds, there is little need to speak here. The gallant men who are making the attempt are facing numerous perils, many of which entirely unknown, and are doing so with their eyes open and in no foolhardy spirit, simply prompted by the desire to prove to the world that the aeroplane is today a practical vehicle for crossing a continent in which landing grounds are few and far between, and in the crossing of which the most trying climatic conditions may have, will almost certainly have to be, contended with.

From a technical point of view, therefore, the proposed flight is of surpassing interest in that it will offer a severe test of the machine and engines. Not only will very wide ranges of temperatures be met with, but also extreme differences in humidity, from very dry, such as the rainless Nile Valley, to the other extreme of heavy rain, tropical rain at that. If the Vickers-Vimy-Rolls Commercial succeeds in making the flight, and we do not doubt that it will,

it will have done an enormous service to aviation by proving that in spite of such adverse conditions a modern aeroplane can weather the severest tropical extremes. If this be so, how much better will the all-metal machine of the future be able to do it, and to do regularly what is at present a hazardous task.

As regards the machine itself, little need be said, as it has already been fully described in FLIGHT. It is a standard Vimy-Commercial, with *monocoque* cabin giving ample space for the occupants. For the present flight most of the seats, all but three in fact, have been removed to give room for tanks and lockers. A considerable number of spare parts are carried so as to enable the crew to make minor repairs *en route*. With the extra tanks the cruising range of the machine is in the neighbourhood of 1,000 miles, which should give a large margin of safety, since the greatest distance between landing grounds is about 450 miles. Thus, even in the case of diverting somewhat from the direct route between aerodromes, the machine should always have ample reserve of petrol. The fear of engine trouble is, of course, always present, but the two Rolls-Royce engines—Eagles of 350 h.p. each—are similar to those which made the Trans-atlantic and the England-Australia flights, and have an enviable reputation for reliability. How they will fare under tropical variations in temperature, and more especially in humidity, remains to be seen. The test is undoubtedly a very severe one.

In the case of the machine itself the test is equally severe, and the experience gained will be invaluable as an indication of the behaviour of an aeroplane under such conditions. The contraction and expansion of bracing wires, the tautening and slacking of fabric, and the power of spars and ribs to keep true under such varying conditions will try to the utmost the soundness of the design. These things can be found out by actual experience only, and the thanks of all who have the future of aviation at heart are due to the men who have volunteered to make the attempt, no less than to those whose generosity and public spirit have made the undertaking possible. We are certain that all our readers will join us in wishing them the very best of luck.

* * *

Why Does the Post Office Hesitate?

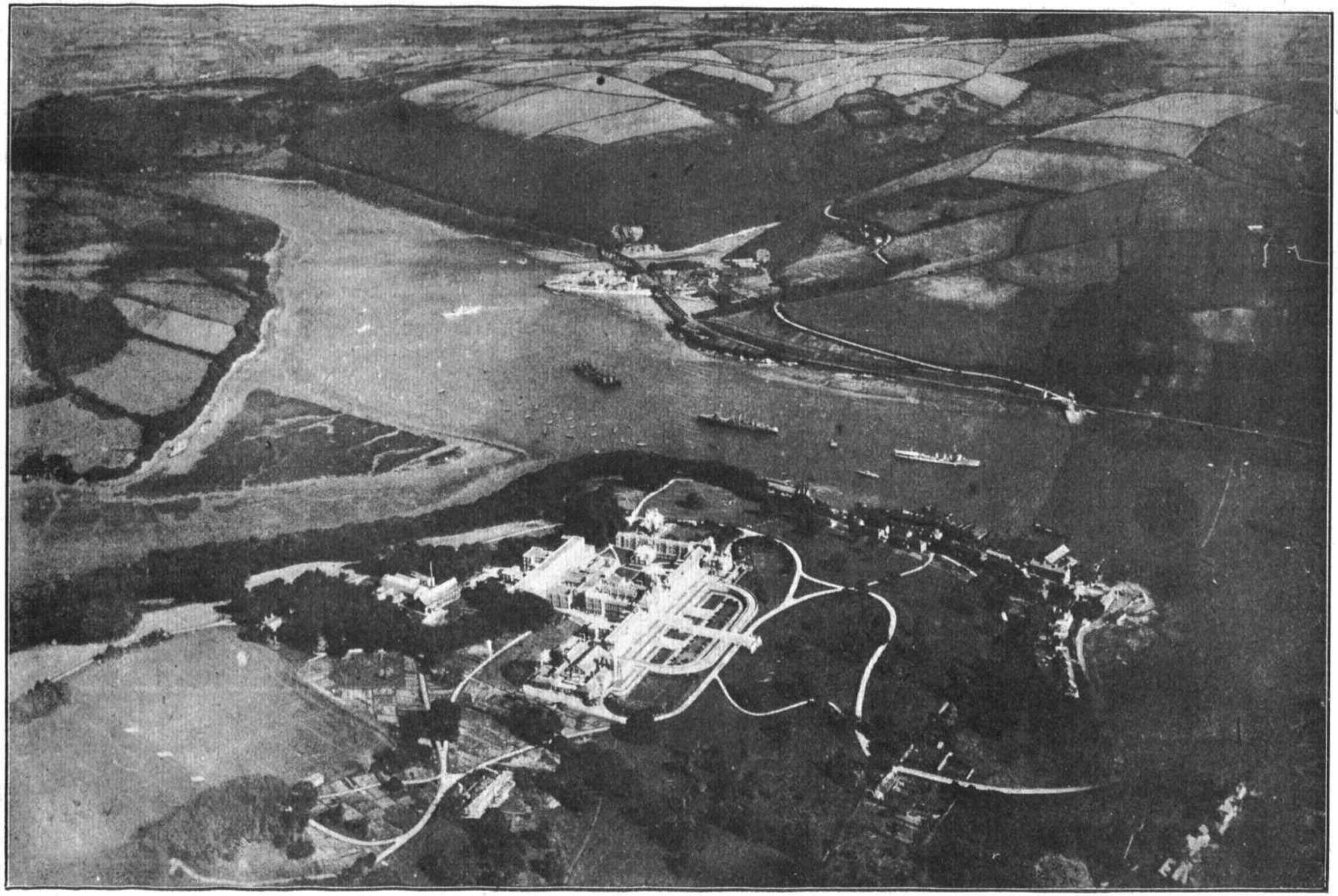
From time to time we have taken occasion to animadvert on the inexplicable supiness of the Government in the matter of encouraging civil aviation, and in particular on the hesitancy of the Post Office to back up enterprise by taking advantage of the facilities offered by aerial services for the carriage of mails. The Post Office authorities apparently take the view that they cannot support such services until they are a proved commercial possibility, and have adopted a policy of "wait and see." They have waited, and if they have sufficient insight they ought now to be able to see that there are indeed commercial possibilities greater than they have ever dreamed. The Airco service between London and Paris has now been working successfully for a sufficiently long period to enable the company to see where it stands in the matter of the rates charged for the conveyance of mail matter between the two capitals, and the experience gained has enabled sensible reductions to be made. Including collection and delivery by motor van between aerodromes and city, and transport between Hounslow and Le Bourget in 2¼ hours, the rate for a parcel weighing from 1 lb. to 10 lbs. is now 2*s* 6*d*. per lb., while for aerial shipments of greater weight the scale is even lower. A consignment weighing 75 lbs. or over will, for example, be accepted at the reduced rate of 1*s*. 6*d*. per lb. By "grande vitesse" train and steamer service, on which the charge for a 1-lb. parcel is about 1*s*. 10*d*. and which does not include delivery to or collection from the stations of departure and arrival, a parcel will probably be from four to five days in transit. By air express a parcel handed in by its consignor up to 10.30 a.m. at any of the 28 offices in London which now accept goods for the service, is delivered in Paris the same afternoon or evening.

It is true that the Post Office has been experimenting with this service and that should stand to its credit, but it is equally true that there are many other directions in which it should show enterprise and encouragement to the new transport. What of the various inland services which have from time to time been submitted for consideration, only to be turned down as not worthy to be seriously entertained? It may be that some of the propositions which have been put up to the authorities have been unpractical and manifestly unworthy of support, but there have been others which we submit should have been adopted without delay. It is not only that the community would be better served by a more rapid transport of its mails, but it is essential for the purposes of the future safety of the realm that aviation should be encouraged by every possible means. Even if this encouragement should mean a comparatively small initial loss to the State the issues bound up in an adequate air reserve are so vital to the Empire that such a loss ought to be incurred. It is not at all certain that a loss would result. Indeed, the probabilities, as the Airco service has demonstrated, lie all the other way. We may hope now that the eyes of the authorities have been opened to the possibility that aerial services, properly organised and efficiently conducted, can be made to pay that there will be an end now of the policy of *laissez faire*.

* * *

Modern Air Power

In *The Times* again last week, "Ex-Squadron Commander" returns to the subject of air power and the vital necessity of our being prepared to defend our shores against aerial aggression. It is true he breaks no new ground, but he is nevertheless doing excellent work in trying to awaken the nation to a sense of the urgency of the question. Unless public opinion can be aroused sufficiently to bring the requisite pressure upon the Government to move them to do something we see no prospect but that the future will find us as unprepared to resist attack from the air as we were when the first Zeppelin raid on these shores occurred in 1915. The Government is too busy with schemes for retaining the goodwill—and the votes—of labour to have time to spare for such comparatively trifling matters as the safety of the realm. "Ex-Squadron Commander" points out that in the realm of flight hopes of success beyond the wildest dreams are offered to any Power which can develop air power in secret. Unlike the creation of armies and navies which are visible to the whole world, a large mercantile air fleet may be built up, ostensibly for the purposes of commerce, without attracting attention. But these same craft are capable of dealing a shattering blow at any nation selected within a few hours' notice.



The Naval Training College at Dartmouth, as seen from an Avro waterplane

If this country is equipped with such a fleet, by means of fostering civil aviation, she will be more effectively defended than in the whole of her history, and that without an enormous expenditure on armaments. For she will be in possession of a weapon which in one night can deal a deadly stroke at the heart of any malefactor.

All this is perfectly true and is what FLIGHT has urged for years and repeatedly ever since the Armistice gave us leisure to regard the future. It has been adequately realised by all whose interests are in the smallest degree associated with aviation. It has been fully appreciated even in official circles, and we have seen an able Under-Secretary for Air resign his office rather than be associated with a policy which is calculated to leave us entirely defenceless against attack by a Power with greater vision than our own Government seems to possess. If ever there was a strong case made out for the immediate and wholehearted support of any movement we submit it has been made out for civil aviation. Yet what do we see?

As "Ex-Squadron Commander" tells us, even within the last few days there has been added to the steadily growing list of firms ceasing to manufacture aircraft the name of a company which has been responsible for some of our best machines. The drawing office has been closed and the whole of the staff dispersed. Our aeronautical industry is fast dying out for lack of that State aid which is bringing our Continental neighbours to a development of air power far superior to our own, destined to prove not only a means of defence but a source of revenue. And while this is happening the Government, which ought long since to have declared its policy so that we might at least know where we stand, is chaffering with the miners about the nationalisation of mines, entailing further national liabilities of thousands of millions of pounds and watching with bated breath the results of by-elections. Are they going to carry out their expressed intention of encouraging civil aerial enterprise or are they not? The question has been put often enough, but there is still no answer forthcoming nor, frankly, do we believe it will until the growing force of public opinion compels a statement.

* * *

How to Get It.

Let it be clear that this is no question of bolstering up a dying industry by the assistance of State funds. It is nothing of the sort, because it is, commercially speaking, a matter of the most complete indifference to the firms constituting that industry, as we pointed out last week, whether they build aircraft or not. Most of them are fully engaged in other businesses which are keeping their works going all the hours they can work, and they are making even better dividends for their shareholders than they could hope to earn in their own proper sphere of aircraft construction. It is first and last a question of the safety of the Empire against unscrupulous attack by an enemy with the wit and vision to realise our hopeless weakness in the face of a menace from the air. This is not by any means a far-fetched statement of the position as it will be within a very few years unless there is a radical alteration in our policy. We are doing nothing, while others are rapidly building up a sound concrete scheme of commercial aviation from which will spring an overwhelming preponderance of military air power. It is all very well in the abstract for our own Government to say it intends to pursue the traditional British policy of allowing aviation to be developed by private enterprise. We have seen how badly "traditional British policy" has let us down within the scope of very recent history. We can most of us remember the time when the traditional British policy was one of "splendid isolation." The course of events showed that this policy made of the Great Britain a species of Ishmaelite trusted by none and even feared by few. It was changed for one of Continental alliances, which was sound enough if we had recognised what our obligations really meant and that there was a possibility of our alliances, or understandings, involving us in a great Continental war. We treated our obligations as we are now treating the question of air power. We failed to raise a force sufficient to adequately fulfil those obligations and the result was the Great War. It is a matter of practical certainty that had we possessed an army on the Continental scale Germany would never have dared to have forced the issue as she did. In other words, Germany believed we were too weak to take the risk of coming to the assistance of France—and we know how nearly right she was in her surmise. We know too well also what our unpreparedness cost us in the end. Unless we are very careful, this traditional British policy, which is after all not immutable, as we have seen, will land us in the same mess again—and we may not have the same fortunate issue out of it.

How is the hand of the Government to be forced? Only, as we have said, by the evolution of a sufficiently powerful body of public opinion, which can only be created by persistent propaganda through such a League as that advocated by Mr. Holt Thomas and others. Even that will take time and we cannot say we are able to view the possibilities of the interval with any satisfaction at all.

▣ ▣ ▣ ▣

Air Work on N.W. Frontier

IT is reported from the N.W. Frontier of India that on January 23 a force of 100 recalcitrant tribesmen, believed to be under the leadership of a fanatical priest named Lala, was caught and bombed by our aeroplanes in Tank Zam.

The Bombay-Karachi Service

AFTER all it was found possible to inaugurate the Bombay-Karachi mail service on January 23. A de H. 10, with 48 lbs. of mail, left Karachi at 2 p.m. and reached Rajkot at 5 p.m. It left at 7.45 a.m. the next day, and arrived at Bombay at 11 a.m. The inward mails were taken on, and Bombay left at 8 a.m. on Jan. 25. Rajkot was reached at 11 a.m. and left at 1 p.m., while the mail arrived at Karachi at 4.30 p.m.

Aeronautical Adviser to China

GROUP CAPTAIN (COLONEL) F. V. HOLT, C.M.G., D.S.O., R.A.F., has been appointed Aeronautical Adviser to the Chinese Government, and is shortly leaving for China to take up his duties.

Czecho Slovakia Air Mail

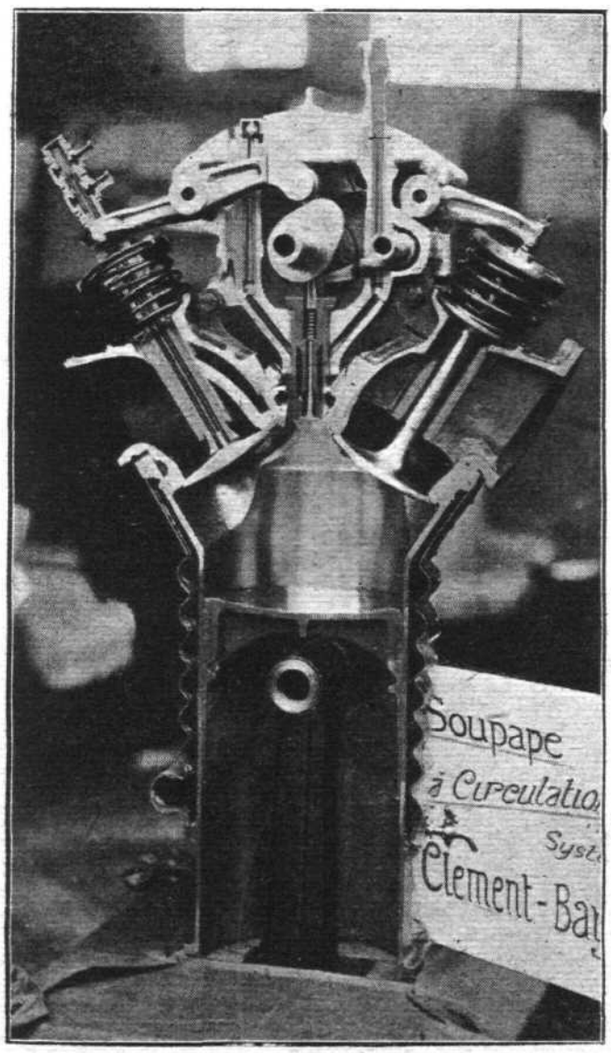
FROM information to hand from Prague, it appears that 19,000,000 kronen, roughly about £79,000, have already been subscribed by British and French interests for the establishment of an aerial post system in Czecho Slovakia. The only other information available is that the equipment is to comprise some 150 aeroplanes.

U.S. Aviators Captured and Released

WHILE carrying a military message on January 28, two U.S. Army aviators—Davis and Grimes—were forced to land in Mexico about 30 miles south of Zapata. They were captured and held in custody by the Mexicans, but were eventually released and returned to American soil.

BY THE TECHNICAL EDITOR

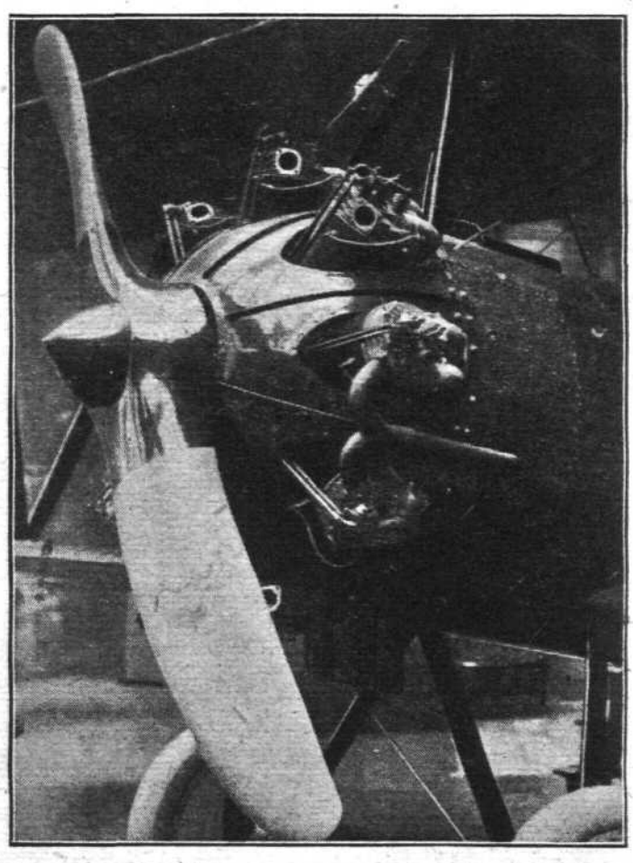
ENGINES AT THE PARIS AERO SHOW



CLEMENT-BAYARD : View of a sectioned cylinder, showing water-cooled exhaust valve

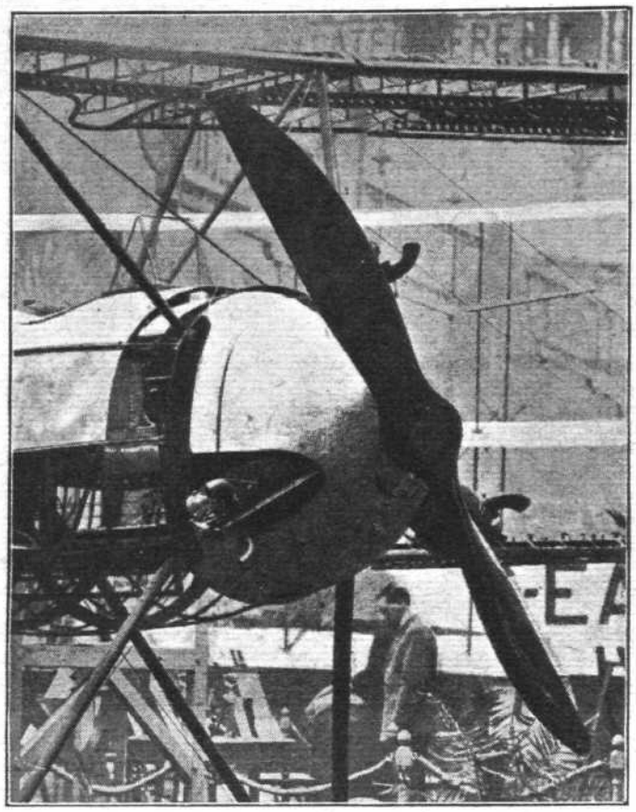
Clément-Bayard

THIS old-established French firm exhibited two airship motors, in addition to a large airscrew with variable pitch. Of these two engines one was a 16-cylindered Vee type rated at 500 h.p. The steel cylinders—bore and stroke 140 mm. and 180 mm. respectively—have overhead valves and camshafts,



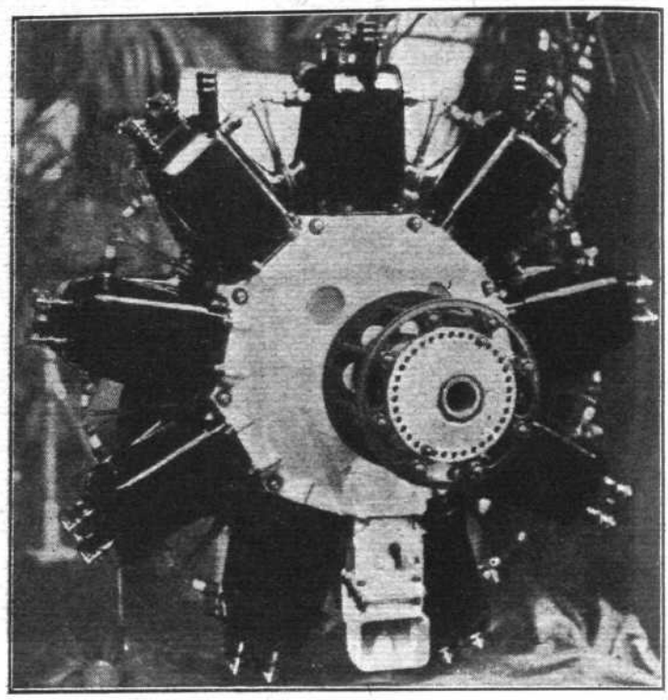
"Flight" Copyright

The 450 h.p. Cosmos "Jupiter" fitted in the Bristol Bullet



"Flight" Copyright
The three-cylindered Cosmos 100 h.p. "Lucifer" engine, fitted on a Boulton and Paul P 10

the cams acting direct on the ends of the valve-stems, much after the fashion of the Hispano-Suiza. The arrangement of the carburettors, of which there are four, is unusual, in that they are fitted on the outside of the Vee, two on each side, while the exhaust pipes are on the inside. The second engine, which has been used extensively on French airships, was a six-cylindered vertical, bore and stroke 165 mm. by 225 mm. The water-jackets are of copper sheet, each cylinder having its separate jacket, which is corrugated as shown in the accompanying photograph. As in the case of the larger engine, there is an overhead camshaft, but operating the valves, which are inclined, by means of rockers. The valves are very large, and in order to prevent the exhaust valve from warping, it is water-cooled. as shown in our photograph,



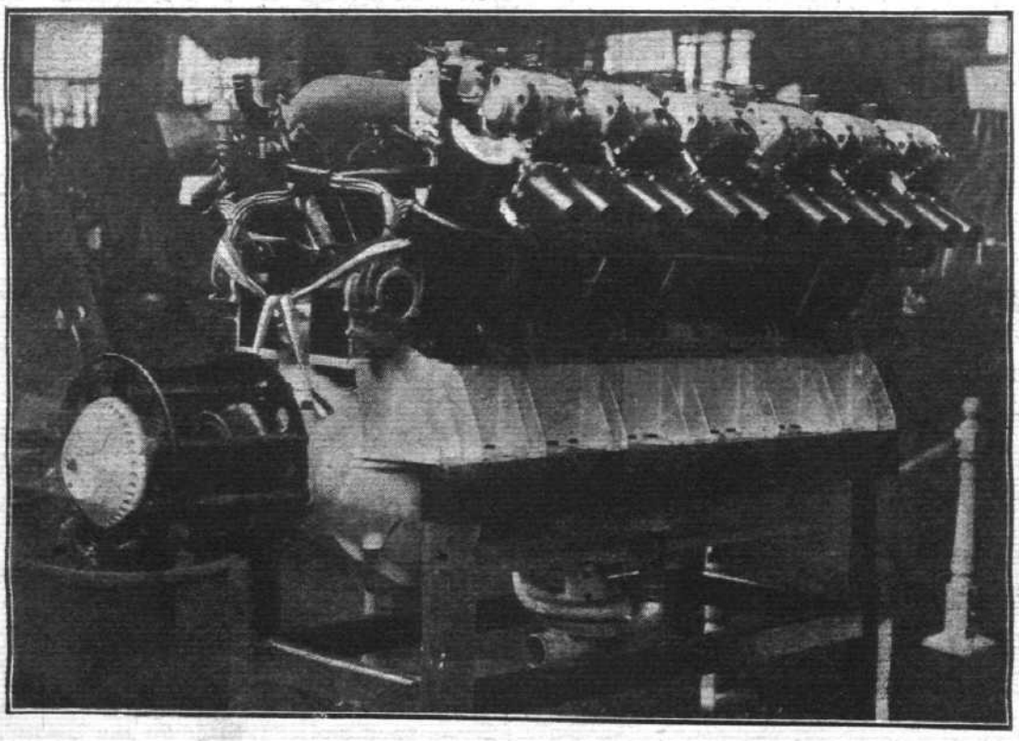
The FIAT TYPE A-18 : Front view

The Cosmos Engines

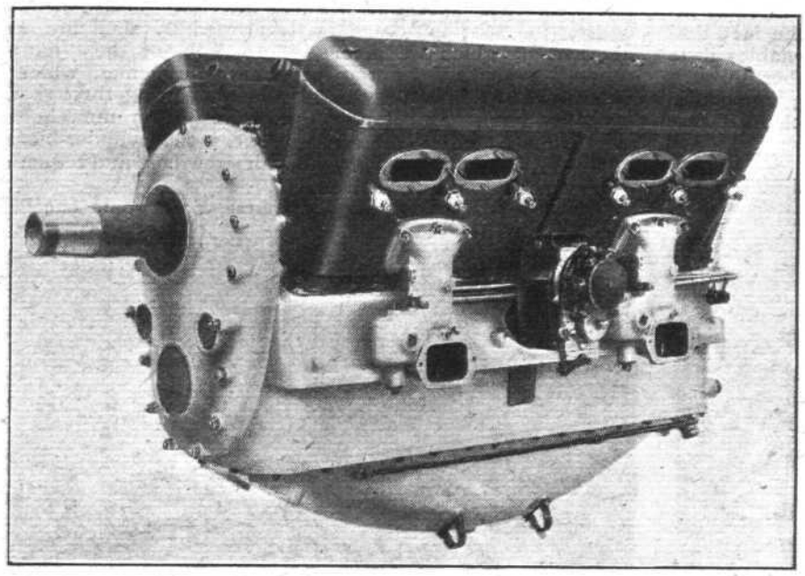
Although not having any separate stand at the Paris Show, the Cosmos Engineering Co., Ltd., were represented at the Show by two engines. One of these was the 450 h.p. "Jupiter" in the Bristol Bullet, and the other a 100 h.p. "Lucifer" in the Boulton and Paul P 10. Both of these engines were described in our issue of December 25 last, and there is, therefore, no need to deal with them here beyond stating their presence at the show.

F.I.A.T.

In addition to their long-distance biplane, the ARF, the Fiat company were represented, on a separate stand, by a fine collection of aero engines. One of these was the Type A 12 bis, of 300 h.p., already well known in this country, of which a bagatelle of 35,000 have been delivered to the Allies since



The Fiat type A-14: This engine, which is rated at 700 h.p., was also fitted in the Fiat long-distance machine exhibited



THE FIAT TYPE A-15 R. : This photograph gives a good idea of the clean design

the outbreak of War. Although probably the majority of these have been absorbed by Italy, a goodly proportion have gone to her Allies. Next in size comes a water-cooled radial of 300 h.p. This engine, which weighs 220 kgs. (about 480 lbs., or 1·6 lbs.h.p.), has nine cylinders arranged radially around a polygonal crank-case of aluminium. The cylinders are steel forgings, with water-jackets welded on. The inlet pipes are housed inside the jackets, and consequently are heated by the water. This arrangement also results in a very clean appearance of the engine. As in other radial engines, the nine connecting-rods are accommodated on a single-throw crankshaft, there being a master connecting-rod and eight auxiliary rods, all of which run on ball bearings. There are four valves to each cylinder, and dual ignition is provided, either of the two magnetos being capable of firing the engine. The A 18 develops 300 h.p. at 1,080 r.p.m., and a maximum of 320 h.p. at 2,000 r.p.m.

A second type exhibited was the A 15 R. This engine, a 12-cylindered Vee of about 400 h.p., was produced towards the end of the War, and was not put into production at the time, but as the tests have shown it to be very satisfactory the Fiat Co. have now decided to put it on the market. As our illustration shows, the A 15 R is of exceptionally clean external appearance. The cylinders are separate steel forgings welded together in groups of three, and having a common water-jacket for each bank of cylinders. The carburettors are bolted to the outside of the cylinder-blocks, there being one for each three cylinders. The inlet pipes pass inside the water-jackets between the outer and the middle cylinder of each group.

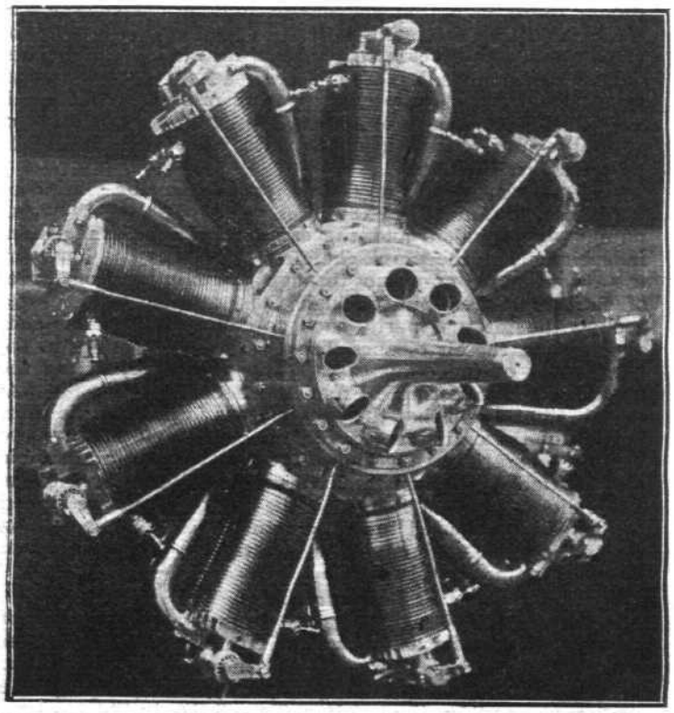
As in the case of the radial engine, there are four valves to each cylinder. In the A 15 R, however, they are operated by overhead camshafts, and the whole valve mechanism is covered with a sheet-steel housing, which not only prevents oil leakage, but also adds to the clean appearance of the engine. The overhead camshafts are driven each by an inclined shaft between two groups of cylinders, the bevel gear operating them being placed on the centre of the crank-shaft. This arrangement again tends towards a clean outward appearance of the engine. As will be seen from our photograph, the propeller is geared down, the ratio being 1·51 to 1. The reduction-gears are of the herring-bone type, and the propeller-shaft is mounted on heavy journal and thrust-ball bearings. The engine, which has a bore and stroke of 120 mm. and 150 mm. respectively, develops 400 h.p. at 2,300 r.p.m., and a maximum of 425 h.p. at 2,500 r.p.m. The weight of the engine dry is 800 lbs., and with water and radiator 903 lbs. The weight per h.p., including water and radiator, is thus only 2·3 lbs.

Finally, there was on the Fiat stand one of the 12-cylindered Vee engines of the A 14 type, similar to that fitted in the Fiat ARF biplane shown on another stand. This engine, which has a bore and stroke of 170 mm. by 210 mm., develops a normal power of 600 h.p. at 1,500 r.p.m., and is capable of a maximum o 720 h.p. at 1700 r.p.m. The cylinders, which are of steel with separate steel water-jackets, are placed at an angle of 60° to one another, and are bolted to the aluminium crank-case. There are four valves per cylinder, two inlet and two exhaust. Overhead camshafts are fitted, operating the valves through rockers. The springing of the valves is somewhat unusual, the springs being placed not round the valve-stems but in a separate casing placed between the two valve-stems. A lug on each side of the spring casing engages with the top of the valve-stems, thus closing both valves, while the forked rockers operate each one valve. Needless to say, adjustments are provided for clearance between rockers and valve-stems and for valve lift. As in the A 15 R, the bevel gear operating the enclosed inclined shafts is placed centrally on the crankshaft. The connecting-rods are of I section, and those of opposed cylinders are accommodated on a common crank, one of the two rods on each crank having a forked big-end. The pistons are of light aluminium alloy, and carry four piston-rings, three at the top and one at the bottom.

As the engine is designed to give its normal power of 600 h.p. at 1,500 r.p.m., direct drive is used, the complications of a reduction-gear thus being avoided. Ignition is by four magnetos, providing dual ignition. There are four plugs to each cylinder, so that in case of one magneto cutting-out the other still furnishes two sparks. Engine breakdown from ignition trouble, therefore, should be a rare occurrence with the F.I.A.T. A 14. There are four carburettors, cast in pairs, placed in the angle between the two banks of cylinders, the material used for the mixing-chambers, etc., being aluminium.

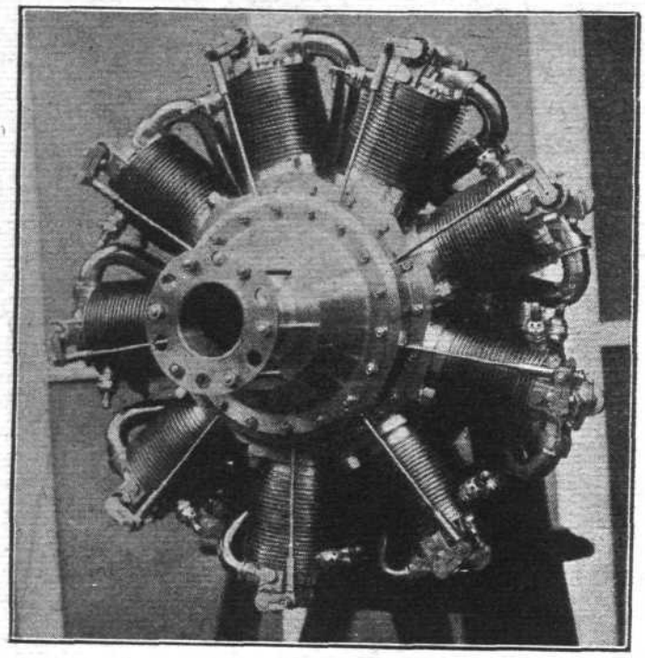
Gnome and Rhône

This firm was represented by a large collection of Gnome and Le Rhône engines, some of which were of historical interest, as, for instance, the original Gnome with smooth cylinders. The majority of the engines were, however, of types already well-known to readers of FLIGHT, and we shall, therefore, confine ourselves to a brief reference to two new types, the Type R of 180 h.p., and the Type Z 9 of 60 h.p. In between these two there are the 80 h.p. Type C and the 120 h.p. Type JB. The R 180 is a nine-cylindered engine resembling closely in external appearance the older models. The induction system is, however, new, inasmuch as the combustible mixture is entirely isolated from the crank-case. The mixture enters through the rear end of the hollow crank-shaft, and is passed from this into a circular chamber on the rear of the crank-case proper, from which the mixture is led



THE 180 H.P. LE RHONE TYPE R : Note the ventilators on the front of the crank-case

to the inlet valves in the head of the cylinders through external induction pipes of the ordinary type. The fact that the crank-case does not contain any mixture enables it to be air-cooled, the air entering the crank-chamber through spouts on the front cover and escaping through openings in the periphery of the crank-chamber. It is claimed that



THE 60 H.P. LE RHONE : Front view

this cooling, in conjunction with the fact that the mixture, being separated from the crank-chamber, reaches the cylinders at a lower temperature, results in a considerable gain in efficiency. Apart from this new induction system, the R 180 appeared to be similar to earlier models.

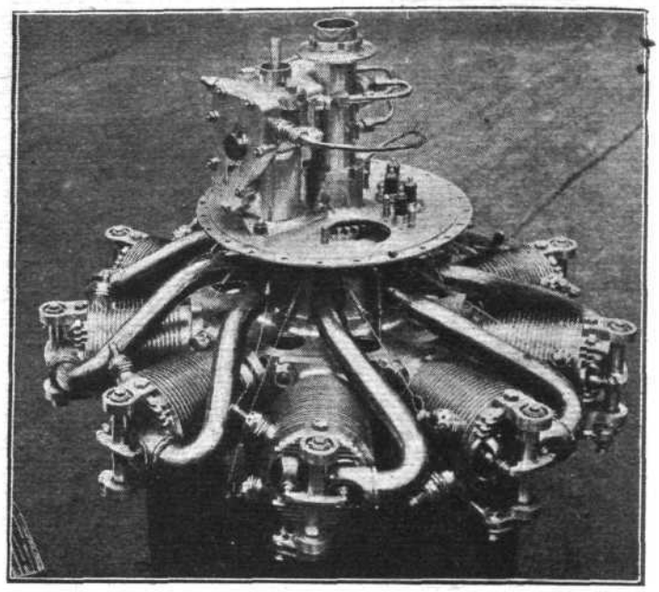
Probably the centre of attraction on the Gnome and Rhône stand was the new little 60 h.p. engine, the type Z9. This engine, which was beautifully constructed, made an instant appeal to all visitors, technical and non-technical alike. The latter admired its exquisite finish and small overall size, the former its design and construction. Certainly the Z9 is a very fine piece of workmanship, while its nine small cylinders, coupled with the fact that the engine is of the rotary type, should result in extremely smooth running. The bore and stroke are 84 by 106 mm. respectively, and at 1,450 r.p.m. the engine is said to develop 60 h.p., this for a weight of 68 kgs. (150 lbs.,or 2·5 lbs./h.p.). The price asked for the engine, taking into consideration the present rate of exchange, is very low, 8,000 francs (or about £200), and one can think of several small British machines into which the Rhône Z9 would fit very well.

Generally speaking, the 60 h.p. engine may be said to be a reduced edition of the 180 h.p. type, possessing the same number of cylinders and the same induction arrangement independent of the crank-chamber. In the Z9, however, the air enters the crank not through spouts in the front cover of the crank-case, but through the propeller boss. After cooling the internal parts, such as connecting-rod big-ends and pistons, the air escapes through circular openings in the back cover of the crank-case. The method of fitting the propeller is interesting. From the accompanying illustrations it will be seen that the back plate is formed by the front portion of the crank-case cover, only the front flange plate being a separate piece. This makes a very neat and simple job, and looks extremely well when the airscrew is in place. The cylinders have a flange at the bottom, and are bolted to, instead of screwed into, the crank-case. The remaining features of the engine remain practically the same as in previous engines of this make.

Hispano-Suiza

A fine display of engines was to be found on the stand of this firm, but, so far as one was able to discover, the engines were all of the types already well-known in this country. The models ranged from the 150 h.p., Type 8Aa, through the 180 h.p., Type 8Aa, the 200 h.p., Type 8 Bb, to the 220 h.p., Type 8 Bc, and the new 300 h.p. model. As already mentioned, there did not appear to be any new models, but some historical ones were not without interest. These included one engine that had been badly strafed by shell fire, and another, of which we give a photograph, of the "moteur canon" type used by the late Capt. Guynemer, which is remarkable for the fact that it allows of firing through the propeller boss. The gun—a quick-firer of 37 mm. bore—is accommodated in the angle between the cylinder-blocks, and fires through the centre of the airscrew boss and reduction gear wheel.

The 300 h.p. engine has, of course, done some excellent

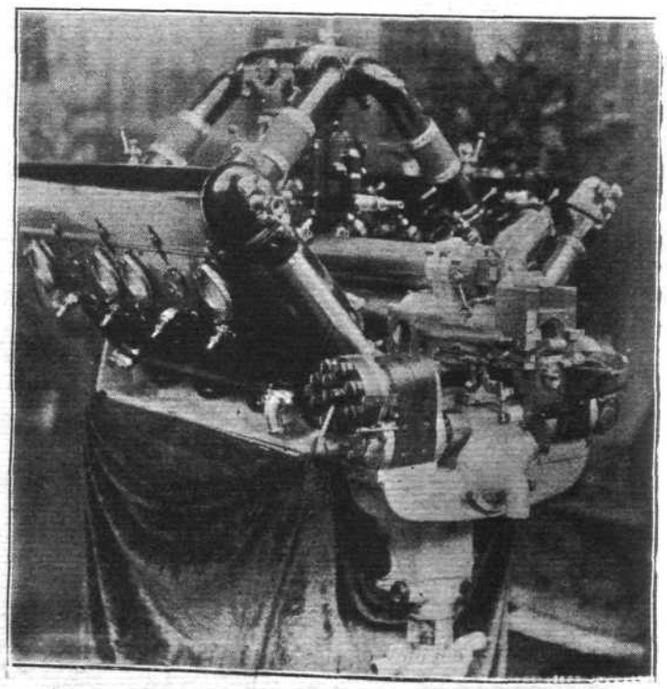


THE RHONE TYPE Z 9-60 : View of engine showing induction pipes and mounting plate. Note ventilation holes in crank case

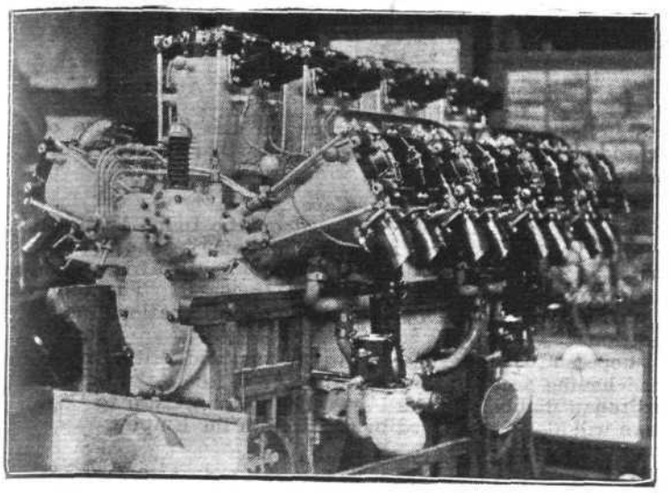
work on various machines of late, notably in some of the famous record flights made by such French pilots as Casale and Sadi Lecointe.

Lorraine-Dietrich

This eminent French house had a most imposing array of engines on their stand, probably the largest engine exhibi[t] at the Show. Of the Vee type of engine there was one 12



THE HISPANO-SUIZA "Moteur Canon" : This engine had been used by the late Capt. Guynemer, and is remarkable for the fact that it accommodates a quick-firing gun which fires through the propeller boss



The 1,000 h.p. Lorraine-Dietrich

cylindered model of 370 h.p., bore and stroke 120 mm. by 170 mm. respectively; one 500-600 h.p. 12-cylindered, 126 by 200 mm.; and one eight-cylindered of 275 h.p. The remaining engines were all of the W or "broad arrow" type, of which three models were shown, one of 400 h.p., one of 500-600 h.p., and one of 1,000 h.p. Among the engines of the two classes there is a general similarity, varied now and then by some detail alteration, which characterises Lorraine-Dietrich design. The 275 h.p. engine is an ordinary Vee type, and calls for little comment. The same, more or less, applies to the 370 h.p. Vee type, which has its cylinders in pairs with a common water-jacket for each pair. The valves, of which there are two to each cylinder, are operated by overhead camshafts, each shaft carrying at one end a Delco distributor. The 500-600 h.p. Vee engine has its camshaft (single) placed in the bottom of the Vee. The smallest of the "broad arrow" type of engines has overhead camshafts and the usual Delco distributors on the ends of the two outer camshafts. The 500-600 h.p. W type, on the other hand, has its valves operated *via* tappets and rockers from two camshafts in the angles between the two Vees.

Of all the engines exhibited on this stand, perhaps the large 1,000 h.p. model is the most interesting, forming as it does the largest single-power unit in the show. Generally speaking, the 1,000 h.p. engine is similar to the 500-600 h.p. W type, except that it has 24 cylinders instead of 12. These are arranged in three banks of eight, with overhead valves, but with the camshafts in the crank-case. As in all the other Lorraine-Dietrich engines. each pair of cylinders has its common water-jacket. The bore and stroke of this engine is 126 mm. by 200 mm. The pistons are of aluminium alloy, with six piston-rings at the top and a scraper ring near the bottom. The connecting-rods are of the tubular type, those of the centre bank being plain, while the rods of the outer banks are forked over the big-ends of the centre rod. The Delco system of ignition is employed.

(To be continued.)

Honours

IN a supplement to the *London Gazette* dated January 30, the following announcements are made :—

The King has been pleased to give orders for the following appointments and awards in recognition of valuable services rendered whilst prisoners of war or interned.

O.B.E. (Military Division).

Lieut. M. JURISS, M.C., 7th Bn., Lond. R., attd. R.A.F.

Mentions.

Capt. T. M. DICKINSON, D.F.C., 16th Cav., I.A., and R.A.F.

Capt. and Bt.-Maj. H. L. REILLY, D.S.O., 82nd Punjabis, I.A., and R.A.F.

It was also announced that the King has been pleased to approve of the following rewards in recognition of gallant conduct and determination displayed in escaping or attempting to escape from captivity.

Mentions.

Lieut. A. A. BAERLEIN, R.F.A., and R.A.F.

Landing Grounds and Aerodromes

THE Air Ministry announces that the following amendments have been made to the official List of Aerodromes :—

The following station has been deleted from List A—

R.A.F. Station.	Nearest Railway Station.	Nearest Town
Flower Down	Winchester.	Winchester.

The following Aerodromes have been deleted from List C—

Aerodrome.	Nearest Railway Station.	Nearest Town.
Curragh.	Newbridge.	Kildare.
Hucknall.	Hucknall.	Nottingham.

The following aerodromes are published as an addition to List D 2—

Licensed Civil Aerodromes.

Aerodromes licensed as "suitable for Avro 504 K and similar types of aircraft only." Except in very few instances, accommodation does not exist. The licences have also been issued for limited periods only.

Aerodrome.	Nearest Railway Station.	Nearest Town.
Cummersdale	Carlisle.	Carlisle.
Billesley.	Kings Heath.	Birmingham.

Telephone Facilities for Civilian Aviators at Penshurst

THE Air Ministry announces that the following Notice to Airmen No. 9 has been issued :—

"Civilian pilots forced to make an emergency landing at the Penshurst Aerodrome may, by the courtesy of the War Office, use the War Office telephone for the purpose of advising the police of their arrival and of obtaining a conveyance for their passengers and mails to the nearest station."

Suspension of Lighthouse Working at Hounslow

THE Air Ministry has issued the following notice to airmen (No. 11) :—

"The Aerial Lighthouse at Hounslow Aerodrome will cease to operate for a short period from Monday, February 2, in order that certain alterations may be made. Due notification will be given when the lighthouse is again in a condition to operate."

The Airship Departments

A CHANGE which is apparent in the January *Navy List* is the disappearance of the Department of the Director of Airship Production and Repairs, formerly under Mr. E. C. Given, and the Department of Airship Equipment, under Brigadier-General E. M. Maitland, C.M.G., D.S.O., from the list of the offices under the Admiralty. This, of course, follows upon the Government's decision that the Air Ministry should be responsible for the airship services, and the transfer to the Ministry from the Admiralty of the airships, stations, machinery, and stores on October 22 last.

To Assist Ex-Officers

IMPRESSIVE appeals were made by Lord Beatty, Lord Haig, and Sir H. Trenchard, the Presidents of the Officers' Association, at a meeting held in connection with that body at the Mansion House on January 30 to bring before the public the aims and objects of this new organisation to assist ex-officers, and to appeal for financial aid.

Sir H. Trenchard said he felt that the nation had not fully done its duty by the many thousands of young officers of the Royal Air Force who, when it was their turn, so gallantly did their duty by the nation. There had been demobilised from the Force more than 26,000 officers and over 21,000 cadets. Most of them were quite young men who went to the Air Force straight from school or college or in the earliest days of their business careers. The Air Force had to take them young, for it was only the young who could master the new element in which they were required to fight. The nation had asked of them the most gallant and devoted service, and they had responded in a manner which could be looked upon only with admiration.

A Memorial to S.A. Flying Officers

IT is proposed to erect a memorial to the memory of South Africans of the Air Service who have fallen in the late war, in the Memorial Chapel, for all the services, which is to be attached to the new church of St. Mary's, Johannesburg, the future Cathedral. It will take the form of an altar in marble enclosed with bronze railing in the Chapel apse, the latter being ornamented with mosaic. The two side windows will have stained glass. The general inscription will be in front of the altar, and the names of the fallen will be inscribed at the sides of the apse, either in marble or bronze.

The Committee, of which Colonel C. A. Bettington is chairman, are anxious to obtain general support from, if possible, every member of the force, and large donations are not sought for. Subscriptions should be sent to the Hon. Sec., R.A.F. Memorial Fund, Box 5649, Johannesburg.

A Holland to Java Flight

NAVAL-LIEUTENANT F. J. BACKER and FLIGHT-LIEUTENANT P. M. VAN WULFFTEN-PALTHE, who are to take charge of the Vickers flying boat which is to fly from Holland to Java, have returned to the Hague from England, where they made a detailed study of the flying boat, its motor, etc.

IMPERIAL AIR ROUTES*

By Maj.-Gen. Sir F. H. SYKES, G.B.E., K.C.B., C.M.G. (Controller-General of Civil Aviation)

IF an Empire air power, both Service and Civil, is developed, organised and co-ordinated, our supremacy in the air may in the future be more valuable in assisting to maintain the peace of the world than our supremacy on the sea has been in the past. If I may, I will quote a few words here from a lecture I gave about two years before the War: "The navies of the world will have to relinquish their present proud position; their *rôle* is that of a floating defence. The Air Service built up from joint Army, Navy and civilian foundations is in the foremost line. Fortresses, arsenals, dockyards, Government offices, factories of war material, are protected from the air . . ."

How then as a world-wide Empire are we affected? The situation of Great Britain from the standpoint of civil aviation differs geographically from that of most other nations. The sea is but one hour's flight from the heart of England. Fog, the notorious variability of our weather, the fact that England lies on the periphery of the system of which Egypt, as I will show later, is the hub, all militate against successful aviation. Yet, from the broader aspect, the Empire is geographically in an unequalled position for establishing air depôts, refuelling bases, and meteorological and wireless stations in every part of the world.

ROUTES

Egypt for some time to come must be the "hub," or, as I have long called it, the Clapham Junction of the India, Australia and Cape routes, and the heart of the whole system of their expansion.

Egypt–India

The route between Egypt and India holds out many advantages. The weather conditions are, on the whole, stable. The time of transit by sea from Port Said to Bombay under normal conditions is nine days; the journey by air, flying by daylight only, takes four days from Kantara to Karachi. Sea transit, it is agreed, could be much accelerated, but I am informed that the cost of this would be very great. An additional advantage is that the Government of India has already established a Civil Air Board under the Department of Commerce and Industry, and is organising internal civil air routes for the carriage of mails. There would be an even more remarkable saving of time in the journey between Cairo and Baghdad, which by air only takes 10 hours, but by the existing sea route *via* Bombay and Karachi as long as three to four weeks.

Geographically, too, the conditions are, on the whole, favourable, and—an important factor—there are valuable potentialities for branch lateral systems into Persia, Mesopotamia and Turkey.

Finally, this route has been chosen for exploitation first because it was thought that in order to obtain experience and data in the quickest possible time for the furtherance of Imperial aviation generally, the simplest part in the great machine should be tested first.

Cairo–Cape

Though work must be continued on the India–Australia route, the next, in order of attraction and offering the greatest results, is that from Egypt to the Cape. South Africa offers potentialities which it is impossible to assess. The route is "all red," and so avoids any possible international complications.

I hope and feel sure that, a British firm and British enterprise having secured the blue ribands of the Atlantic and Australian flights, the third great flight from Cairo to Cape Town will also be achieved by a citizen of the Empire.

India–Australia

Concurrently, the great chain between India and Australia has to be developed. It is possible that this route might also be made all red by the use of Christmas Island, but, apart from the difficulties of making an aerodrome there, we are singularly fortunate in having the cordial co-operation of both the Dutch Government in Holland and of the Governor-General of the Dutch East Indies.

England–Egypt

The route which will eventually be used between the Home Country and our Egyptian aerial hub requires special treatment. The practicability of Malta as an intermediate landing-ground is being considered, so again ensuring an all red route as soon as a range of 1,300 miles has become a normal effective flying stage. In the event of this stage being better adapted to the employment of airships, a base at Malta will also be a necessity.

England–Canada

Last, but by no means least, of the Imperial routes, which require development, is one from England to Canada, which will bring us into more immediate touch with the other great half of the English-speaking world.

Another route which cannot be neglected is that between England and the West Indies, with the Azores as a stepping-stone. From some central point in the West Indies a connecting service of flying-boats could be usefully employed for the distribution of mails.

FUTURE REQUIREMENTS

What are our requirements in traversing the wide fields of exploration and expansion which lie open to us?

It is imperative that the first line of the fighting force of the future should be always on a war footing. We have all seen the great value of the aeroplane in war; the next war will in all probability open with a fight for the mastery of the air which will be secured by attack and defence.

* Abstract of a paper read before the Royal Geographical Society on Feb. 3.

LONDON–CAIRO–CAPE BY AIR: The Vickers-Vimy-Rolls commercial machine, chartered by *The Times*, which is now *en route* by air for Cape Town *via* Cairo.

FLIGHT
THE AIRCRAFT ENGINEER AIRSHIPS

At the moment of the Armistice we were only on the verge of seeing the capabilities and effects of long-range bombing. In order to assume the offensive in war, we must have at our immediate disposal an efficient staff and an efficient personnel. Civil aviation will be the best method of ensuring a reserve of capable airmen to draw upon.

I hope, too, that before long the Air Force of the Empire will be welded for strategical purposes into one force co-ordinated by an Imperial Air Staff.

The analogy of the Navy and the Mercantile Marine is close in more ways than one. We can, as I say, draw upon the commercial service in time of war, but as it is impossible to convert a merchant vessel into a first-class battle-cruiser, so it will be impossible to convert commercial aeroplanes into first-class fighting machines, though it is true that civil aircraft can be more easily used for direct war action, such as bombing, than a converted ship of the Mercantile Marine. In peace a change of relative balance will naturally ensue between civil aviation and military aviation. Military aviation must be circumscribed on the grounds of finance, whilst civil aviation must never cease to expand and gradually to produce revenue. Military design must be concentrated on speed, climbing, manœuvrability and fire-power. Commercial design must be fixed on one object only—the development of the machine as a reliable commercial vehicle.

Each will co-operate with the other, but each has its own orbit; the one with its eyes on direct fighting Imperial defence, the other as an instrument for the development of Imperial trade, which can be used if necessary as a great aerial reserve.

There is no more important factor in the success of commercial aviation than efficient ground and navigation organisation embracing aerodrome, repair and depôt arrangements, air survey, cartography, route directions, aerial marks and beacons, and all forms of communication and signalling, wireless, visual, land lines, codes and cyphers. Nine-tenths of the problem may be said to consist of ground work.

The co-operation of the Post Office is important. The air mails are the real foundation of the whole system upon which Imperial routes must be based. To give an example: Before the War mails from the United Kingdom took on an average 29 days to reach Adelaide. When aircraft are used in this service, the time will be reduced to about 16 days, and to considerably less as soon as night flying can be organised.

The chief difficulty to be overcome is that of cost. At present 2*s.* 6*d.* is charged for carrying a letter from London to Paris, but it is quite possible that, with increased confidence, experience and bulk of matter, a letter may be sent from London to Paris by air at a very much lower charge.

The following table gives the estimated gross weight of weekly letter mail to various parts of the Empire, a portion of which may in the future be carried over the Imperial air routes:—*Destination:* Egypt, 2,000 lbs.; Cape, 4,000 lbs.; India, 8,500 lbs.; Australia, 7,000 lbs.; New Zealand, 2,500 lbs.

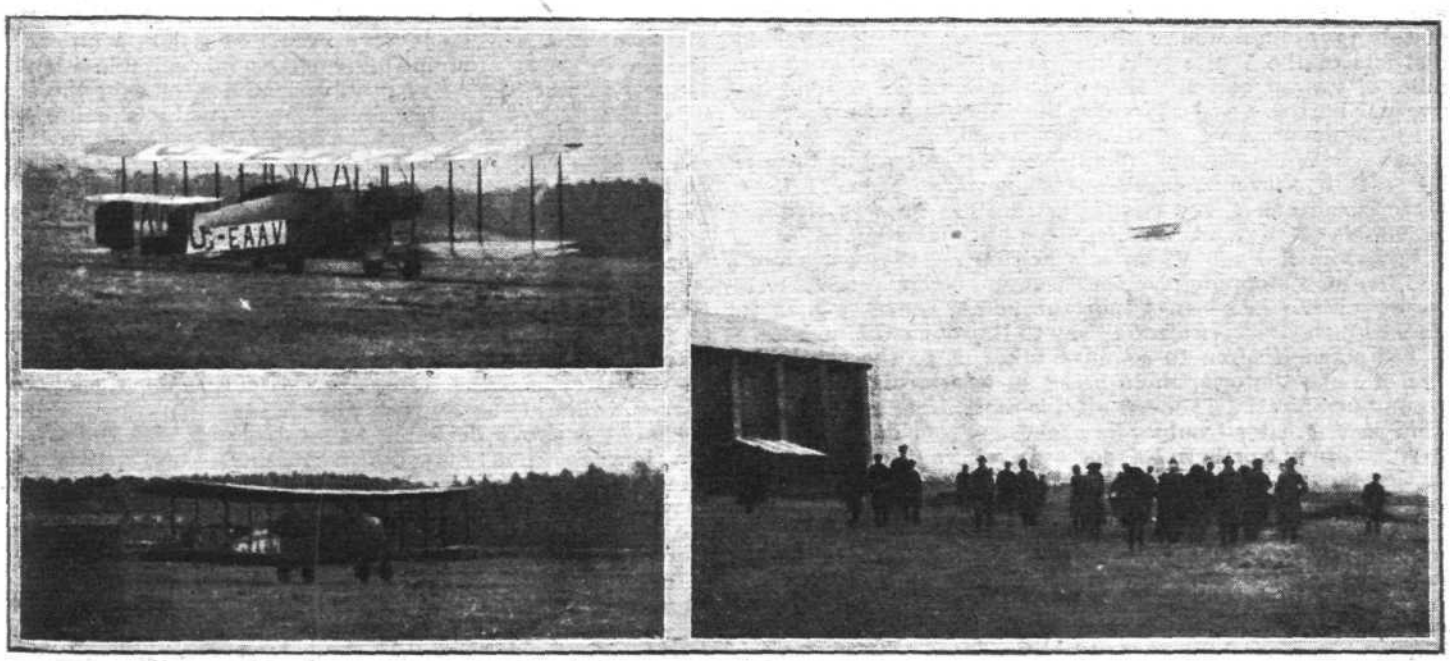
Speed, reliability, and cheapness of cost are the blood and nerves of aviation. I estimate that in order to compete successfully in commerce, aircraft must aim at being in a position to complete a journey in one-third of the time taken by other methods of transport. Increased speed may be obtained in two ways—first, by the improvement of ground organisation, so enabling night flying, and the employment of an effective relay system; and, second, by the improvement and development of the engine. Meteorological conditions affecting night flying are distinctly favourable, the sky during most months of the year being three to four times clearer by night than by day and the winds on the landing-grounds being very considerably weaker, though above 150 ft. the reverse is true. To ensure the safety of night flying a great deal of work still remains to be done, such as the marking and lighting of aerodromes, the perfection of signals, and establishment of lighthouses. It is certain that on long routes a relay system will be adopted. The password of commercial aviation must be "Safety first."

From May 1 to December 31 of last year the total number of hours flown by the machines owned by the principal firms engaged in civil aviation, exclusive of the competition flights from England to Australia, amounted to 8,368; the number of flights to 35,330; the mileage to 593,000; and the passengers carried to 64,416. During this period 18 accidents occurred, resulting in the death of four pilots and one passenger, and injury to six pilots and 10 passengers. This represents one accident for 32,900 miles flown. In other words, the rate of deaths per thousand hours flown was ·48 pilot and ·06 passenger, or ·016 passenger per thousand passengers carried.

I may mention that while 67,143 lbs. of goods were carried by air between May 1 and December 31, the value of the imports and exports by air for the United Kingdom during the period August 26 to December 31, 1919, was: Imports about £60,000 and exports £31,200.

I should like now to add a few words on the future air policy of the component parts of the Empire. The principles of Service and civil air requirements apply equally to the Dominions as to the Mother Country. The enemy of the future may arise nearer to a Dominion than to England herself; each, therefore, while keeping close touch with Home in matters of common policy, should, in my opinion, have a small Service and a large civil air fleet to meet its own strategic and commercial needs, and the Empire air organisation should be able quickly to concentrate for its assistance. In Canada the Air Board which, as in other Dominions, has been recently constituted, fully appreciates the close relationship and interaction between Service and civil aviation. It realises the desirability for civil pilots to undergo a short training in an Air Militia, and the utility of aircraft, both heavier and lighter than air, for forest patrol and survey work, more especially in the northern areas of all the provinces from Quebec westwards.

Experience gained in each part of the Empire should be exchanged for the good of all, and so a mighty air commerce



LONDON-CAIRO-CAPE BY AIR: Start of the Vickers-Vimy-Rolls aeroplane at 11.30 a.m. from Brooklands on January 24 last. Below (left) the machine is just leaving the ground, and on the right she is "well away"

be gradually built up which will foster the industry of the Imperial Commonwealth; act in unity indirectly both as a guardian of the peace and as a great reserve to the service of scientific skill; and finally provide trained personnel and material in the last resort of war.

II. DESCRIPTION OF THE ROUTES

Egypt to India

Starting from Kantara the aerial route to India proceeds across the Sinai desert through Palestine to Damascus, a considerable amount of difficult and hilly country being covered in the flight. From Damascus an easterly course is steered across the Syrian desert to Baghdad, whence, under conditions of little geographical difficulty, a south-easterly course, more or less following the river Tigris, brings us to Basrah. From Basrah the northern shore of the Persian Gulf is followed *via* Bushire to Bunder Abbas. It is necessary, in this section, to skirt the shore, as the mountainous nature of the country and scarcity of possible landing-grounds render a direct course undesirable. From Bunder Abbas to Karachi *via* Charbar it is once again a question of skirting the seaboard owing to the inhospitable and mountainous nature of the country, were a point to point course steered. Other aerodromes which exist on this route have at present only been organised as emergency landing-grounds. Once in India, there are several alternative routes in the trans-Indian journey.

The two principal routes cross India from west to east, both starting from Karachi, which is, from a flying point of view, the gate of India. The northern route proceeds to Nazaribad, thence striking north-east to Delhi, and so to Calcutta *via* Cawnpore, Allahabad and Gya. On this route there are a number of other aerodromes which offer facilities in case of emergency. The more southerly and direct route, though at present not quite so well served with intermediate stopping places, is that *via* Bombay, our first stage from Karachi being Ahmadabad, whence the course more or less follows the Bombay, Baroda and Central India Railway to Kalyan (the aerodrome for Bombay). The route on to Calcutta is almost due east, passing through Nagpur. Other aerodromes are under construction at Raipur and Jharsuguda. In connection with the Egypt-India route the Indian Post Office has inaugurated a mail service between Bombay and Karachi which will accelerate the delivery of letters in the Provinces of Sindh and Baluchistan.

Cairo to Cape Town

The stepping-stones of this great all-red route have been actually placed, and pioneer machines are now on the way.

It will be realised that to have established a chain of aerodromes through the length of the continent of Africa, a distance by existing methods of travel of 6,223 miles, to have successfully contended with the geographical and physical difficulties, is no small achievement.

From Cairo the course of the Nile is followed to Wadi Halfa, and thence across the desert to Sherick, from which place the Nile is once more the airman's guide to Khartoum. Across the desert areas from Cairo to Khartoum natural aerodromes, requiring little improvement, are readily available. The southern end of this zone marks the terminus of the Egyptian-Soudan railways at Senaar. With the Sudd districts of the White Nile, an area of some 35,000 square miles of swamp, and the fores s of the Southern Soudan between Khartoum and Mongalla, the difficulties of aerodrome construction are very materially increased.

Between Mongalla and Jinja, which it is interesting to note is 2,132 ft. above sea-level, on the northern shore of Lake Victoria, an emergency landing-ground has been established at Nimule on the southern boundary of the Soudan.

From Jinja, Lake Victoria is skirted on the east shore, and the next stopping-place is Kisumu, on the north-eastern corner of the lake—an important point, connecting as it does with the East African railway to Nairobi and Mombasa.

The stage Kisumu to Mwanza takes us to the southerly end of Lake Victoria, there being an intermediate landing-ground at Shirati. Though all this section of country is far from easy, greater troubles lie ahead. From Lake Victoria to Abercorn in Northern Rhodesia *via* Tabora (the late capital of German East Africa), is a difficult piece of country. A large stretch of Central African forest is unpleasant to contemplate as a possible enforced stopping-place, although, owing to the energy of our survey parties and the goodwill of the local authorities, even here emergency grounds have been made available at Shinyanza and Zimba.

From Abercorn there is a further difficult stretch to Broken Hill, and an emergency ground has been prepared at N'dola. The journey from Abercorn to N'dola is 341 miles. This is the longest stage without a prepared emergency ground on the entire route, but the intermediate country has been surveyed, and more than one place reported on as offering landing facilities in the event of necessity. From N'dola, to Broken Hill and onwards to Pretoria *via* Livingstone Bulawayo and Palapwe (where we have benefitted so much from the assistance of Chief Khama), the route roughly follows the railway, and although the dense forest country in the neighbourhood of Livingstone naturally presents difficulties, the journey, in view of the many facilities which are now within reach of every stopping-place, is not a bad one.

The next aerodrome is at Johannesburg, which lies 6,000 ft. above sea level, the greatest elevation on the route. From here there is a gradual falling in the elevation of the aerodromes to Cape Town.

Bloemfontein, Victoria West and Beaufort West all have aerodromes on the route, and in view of the difficulty of the Zwarte-Bergen range, which it is necessary to cross before reaching Cape Town, an emergency landing-ground has been established at Touws River. This has been found necessary because the top of the mountain range referred to—which will necessitate a climb of well over 7,000 ft.—is often covered with low clouds, rendering the actual approach to Cape Town somewhat dangerous.

Generally speaking, the latter stages of the journey across the Transvaal and Cape Colony have not presented anything like the difficulties encountered further north, the more open nature of the country lending itself better to the requirements of the aviator, although frequently the veldt country with its rocky kopjes has made the selection of landing-grounds difficult.

In considering the whole route, it is interesting to record that there are no less than 43 prepared aerodromes giving 42 stages of an average length of just over 124 miles each. Of the 43 aerodromes, 24 are at present organised as petrol and oil stations, giving an average journey of 226 miles between re-fuelling bases. The total distance to be covered is approximately 5,206 miles.

In Africa special consideration has been given to the inauguration of a mail and passenger service from Cairo along the course of the Nile to Khartoum, and on to Kisumu on Lake Victoria. Under present conditions certain stages of this journey have to be conducted by carriers, a method both slow and expensive. It appears that here, at any rate, the most economic mode of travelling would be by air, particularly as it seems doubtful whether a Cape to Cairo railway would pay over this section of its line.

India to Australia

From Calcutta the route to Australia as flown by Sir Ross Smith is *via* Akyab to Rangoon, and thence, after skirting the coast of Burma for about 100 miles, it strikes across country to Bangkok. Here some hazardous flying over a very mountainous district is involved. The next stage from Bangkok necessitates a journey down the Gulf of Siam to Singapore. Here again geographical conditions are difficult, the ground being extremely precipitous.

Leaving Singapore, flight is continued to Kalidjati in Java, and on *via* Surabaya and Bima to Atamboea in Dutch Timor, which is within 450 miles of Port Darwin. All the latter stages of this journey involve very material difficulties, as it is a question of flying over either inhospitable islands, from the point of view of possible landings, or over the sea. The alternatives to this route are:—(1) by skirting the western coasts of Burma and the Malay Peninsula rather than crossing the mountains to Bangkok. Several possible landing-grounds have been reported in this area as the result of a survey recently undertaken by Gen. A. E. Borton; and (2) an alternative which has been favourably reported on by Gen. Borton, the use of a flying-boat from Calcutta *via* Akyab, Rangoon, Mergui, Penang, Singapore, Muntok (Banka), Batavia, Surabaya (Java), Bima, Keopang Bay (Timor) and so to Port Darwin. If the latter method be adopted, undoubtedly many of the geographical disadvantages and difficulties which a land machine suffers would disappear, as sheltered harbours suitable for flying-boats exist.

Should it prove desirable to establish an All-Red route, the journey from Singapore to Australia may, perhaps, at some future date be broken at Christmas Island, south of Java, 810 statute miles from Singapore, and 949 miles from the coast of Australia. Incidentally, I hope that some day there will be a link between this route and one to China.

In Australia one of the chief disadvantages of the present transport system is the lack of a trans-continental railway between the populous districts in the south and the sparsely populated country of the north. A trans-continental air route such as has been opened up from Port Darwin to Melbourne, with some 11 aerodromes either constructed or in course of construction, may well prove the most economical

method of carrying mails, light packages and even passengers. The actual journey has already been flown both ways.

New Zealand, with its two islands and long seaboard, seems chosen by Nature for the use of seaplanes. In regard to New Zealand, proposals have already been put forward for the creation of an air mail service between Auckland and Wellington, Wellington and Christchurch, and there can be no doubt from the reports received that such a service would entail a great saving of time, but the high winds encountered render steady aerial navigation somewhat difficult.

England to Egypt

Between Paris and Lyons the course is over typical north-western French country as far as Auxerre, and a forced landing, if necessary, may be safely made almost anywhere. South of Auxerre the country becomes more hilly and wooded, and difficulties increase, although no really high ground is passed. From Lyons the valley of the Rhone is followed as far as Marseilles, and presents few difficulties.

The next stage to Pisa is a long and difficult one, as in view of the hilly nature of the country along the coast and the comparatively few landing-grounds available, it has been found better to take a more or less direct oversea course of nearly 200 miles.

From Lyons, however, an alternative route over the Mt. Cenis Pass may be taken by proceeding *via* Chambery and Modane across the Italian frontier to Turin.

Aerodromes exist both at Chambery and Turin, and possible landing-grounds are available in the neighbourhood of the railway nearly as far as Modane. Although through the actual Mt. Cenis Pass there is a stretch of bad country, the total distance offering difficulties does not perhaps exceed 50 miles, and although Mt. Cenis itself is 11,600 odd ft. in height, the Pass is only some 6,000 ft.

Beyond Turin it is good flying country, and the course lies south of Milan to Bologna, and down the eastern coast of Italy to Foggia. This route has been favourably reported on, and in view of its directness is one worthy of the closest consideration.

Geographically Italy is peculiar from a flying point of view owing to the height of the central range or watershed, but in the northerly or southerly flight it is possible to travel over the coastal plain to Rome with many intermediate landing-grounds available.

At Rome an alternative route is possible, namely by crossing to Foggia, a flight which involves a climb to nearly 10,000 ft.; from Foggia to Brindisi or Taranto, and so across the Straits of Otranto to Athens. This last stage covers some very difficult and mountainous country.

From Athens to Suda Bay is an overseas flight of about 170 miles. The island of Crete is not ideal from the aviator's point of view, the mountains being of such a height as to involve a climb of between 9,000 and 10,000 ft. before the journey southwards can be continued, unless the island be circumnavigated.

From Crete to Sollum on the north African coast is 242 miles over the Mediterranean. Thence, following the coast to Alexandria, the flight to Cairo is completed usually under favourable meteorological conditions.

To return to Rome; if instead of utilising the alternative I have just described, a continued course down the west coast of Italy is taken, a further landing place is available at Naples, thus making the journey to Africa *via* Malta, with a possible landing at Catania in Sicily.

The advantages of this route are obvious, involving as it does crossing the territory of two foreign powers only, but the actual mileage is greater and the oversea portion a long one.

A permanent aerodrome has not been constructed in Malta as yet, but it is a point now under consideration, although owing to the rocky nature of the island there are considerable difficulties to be contended with.

From Malta to the African coast, if Tripoli be our objective, is about 210 miles. On the other hand, Ben Ghasi, although involving a long oversea stretch of about 400 miles, is considerably more direct.

Whichever course is chosen, once the African coast is reached, the flight to Egypt presents comparatively few difficulties. All the north African desert country makes up to a certain extent for its general absence of civilisation by the good landing facilities it offers.

England to Canada

From Cork, in the south of Ireland, to St. John's, Newfoundland, is a journey of 1,935 statute miles, although the actual point to point journey from the extreme west coast of Ireland works out at materially under 1,900 miles.

Once in Newfoundland the journey to the mainland is relatively simple—some 600 miles to Halifax—thence to Quebec and Montreal.

Great possibilities are open for the development of aeria routes from Montreal across the continent, touching, for instance, at Toronto. Port Arthur, Winnipeg, Saskatoon, Edmonton—Vancouver being the ultimate goal.

The use of flying-boats in Canada will undoubtedly be greatly developed owing to the large amount of open water in innumerable lakes, and after what has already been accomplished in the establishment of aerial routes, it does not call for much imagination to conceive a flying-boat route spanning the entire continent.

Canada, as a whole, offers a good example of the geographical conditions affecting ordinary commercial intercourse by air and the utility of aircraft in providing the means of developing virgin lands where neither railways nor telegraphs have yet penetrated. For instance, an air route employing either land or water aircraft might be established on the line of the Great Lakes, linking up the commercial centre of Montreal with Port Arthur, the gateway of the west; then onwards to Winnipeg, whence lines could radiate into the North-West. Or again, an air organisation could assist the settlers who are ever pushing their habitations and carrying civilisation into the northern districts of Quebec, Ontario and the Prairie Provinces.

III. CONCLUSION

What of the future? We are still at the experimental stage of aviation. It is essential that those who are responsible for its development show imagination and foresight. It is not sufficient merely to keep abreast of immediate requirements.

Sound finance and an economic system are the bed-rock of Imperial commercial aviation. Though charges are at present high, the great speed of aircraft, the absence of road or rail wear and tear, are both in its favour. Increased public confidence and consequent increase in traffic will rectify cost.

But in the meantime how is the machine to be kept working? How much responsibility must be assumed by the State? State ownership has its champions, but is against British instinct. The principle is generally accepted that bureaucratic control destroys competition and initiative. The State can help—in the organisation of the great routes which I have described; in meteorological and wireless services; in the institution of research and experiment. But for a time, at any rate, it must do more. It must be recognised that though private enterprise must itself be vigorous and independent in its methods, at the beginning the British aircraft industry cannot live unsupported. Direct assistance is a necessity. Subsidised competitors are in the field. France is straining the pace, Italy is pushing her interests, the United States is grappling with the problem, Germany is making feverish efforts. The signposts are clear. An Empire policy must be formed. In the no distant future, after the crucial domestic problems arising out of the War have received first treatment, the Imperial and Dominion Governments must define and adopt a considered policy towards aviation.

It is not enough to believe—as I firmly do—that aerial transport being right is bound eventually to succeed. The seasoned tree can stand alone—the shooting sapling must be stayed.

Some of the requirements of aviation on an Empire basis are:—

1. The maintenance of a highly efficient fighting force.
2. The expansion of commercial aviation to promote British trade and to supplement the fighting force when necessary by a reserve of personnel and material, knowledge and experience.
3. The co-ordination and co-operation of aerial communication throughout the Empire, and its relations to other countries.
4. The organisation of routes, aerodromes, ground communication and meteorological services on an Imperial basis.
5. The energetic promotion of research and encouragement of design.
6. Money to assist the institution of experimental mail services.
7. The encouragement of land survey, forest patrol, and other work in which aircraft can be utilised.

There are great handicaps from physical, technical, operational, and financial points of view, but the strides which aviation has made in the past will be more than equalled in the future. The deadening blanket of scepticism or apathy which undoubtedly exists in official, commercial, and, in fact, in every grade of society, and which has always greeted the birth of any new great development in the normal activities of the world, will gradually disappear. Every decade has had its doubting Thomas.

The responsibility must be faced. If it is, I am quite

certain that that initiative and grit which has always enabled this country and the Empire to lead the world will not let us lag behind in this new and all-important branch of future human activity.

This year will, I hope, go down to history as marking the birth of a sound, virile and truly Imperial Air Policy.

The Prince of Wales said there was no doubt that geography was going to help aviation and aviation was going to help geography. The importance to the Empire of the development of aviation was immense. It was certainly very tantalising to see all those red lines on the maps and to think that later on it might be possible for him to fly round the Empire instead of going by sea.

Gen. Sir Geoffrey Salmond, who was in command of the R.A.F. in the Near East when the Armistice was signed, described the flights that were undertaken by him and other officers in making surveys over the Nile after the cessation of hostilities. He emphasised that it was no good thinking of air routes unless they thought of the organisation by which they were to be linked up, and there was no good thinking of organisations unless we insisted on the three basic principles upon which successful air transport rested. The first was that mails were the paying load in air transport; secondly, the load must be sufficiently large to pay for the individual journey; and the third was the enormous cost of maintenance. It had been calculated that for every twin-engined aeroplane the cost worked out at 10*s*. per ton-mile, which meant that for a 1,000-miles journey an aeroplane must earn £500. The principal load would always be mails, and mails could only be picked up at industrial centres, which were few and far between in the areas under discussion. Gen. Salmond described four areas of organisation which might be linked up under the Air Ministry, and expressed the view that the time had arrived for the formation of a strong and vigorous Imperial Air League, whose mission would be not only to educate public opinion, but also to deal with the solution of the air transport question at home.

Mr. Winston Churchill said they would need all the help they could get in the years immediately before them. There was no doubt whatever that the War gave to aviation an impulse altogether out of proportion to what could be expected in times of peace. Aeroplanes were fanned into the air on the furious wind of a great struggle, when money and danger hardly counted at all in human calculations. Now we had got back to prosaic times, when risk was a deterrent, and when money made its appeal not only to the Chancellor of the Exchequer but to the taxpayer; and, therefore, the years that immediately followed the great struggle must be years of great difficulty. It was a desert area that we had to fly across the next few years before we reached the development in aviation which would enable the world to catch up the normal pace of the development made during the War. Unless we kept the lead in the air, commercially and militarily, we could not possibly enjoy that safety which during so many centuries our Navy had hitherto bestowed upon us.

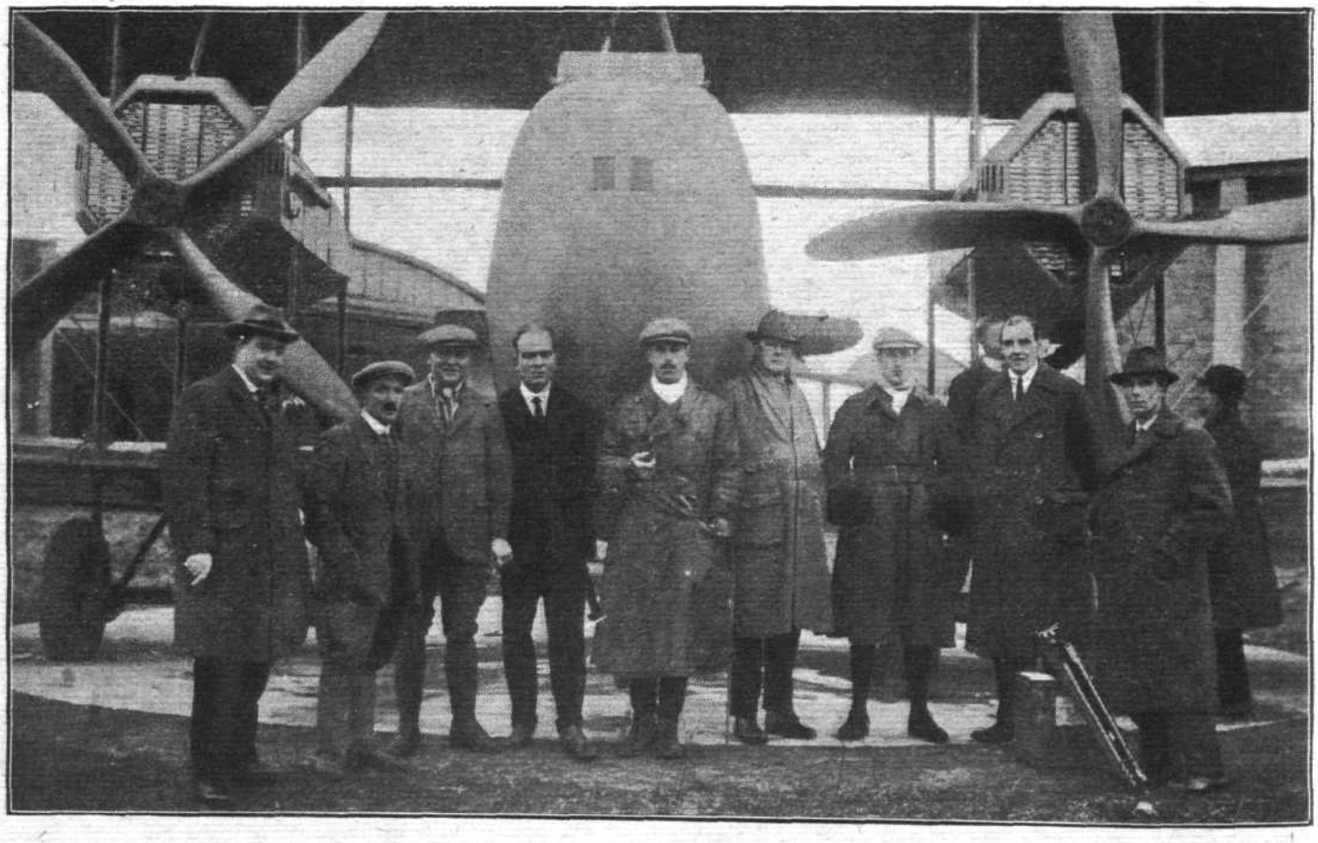
▣ ▣ ▣ ▣

THE CAPE TO CAIRO ROUTE

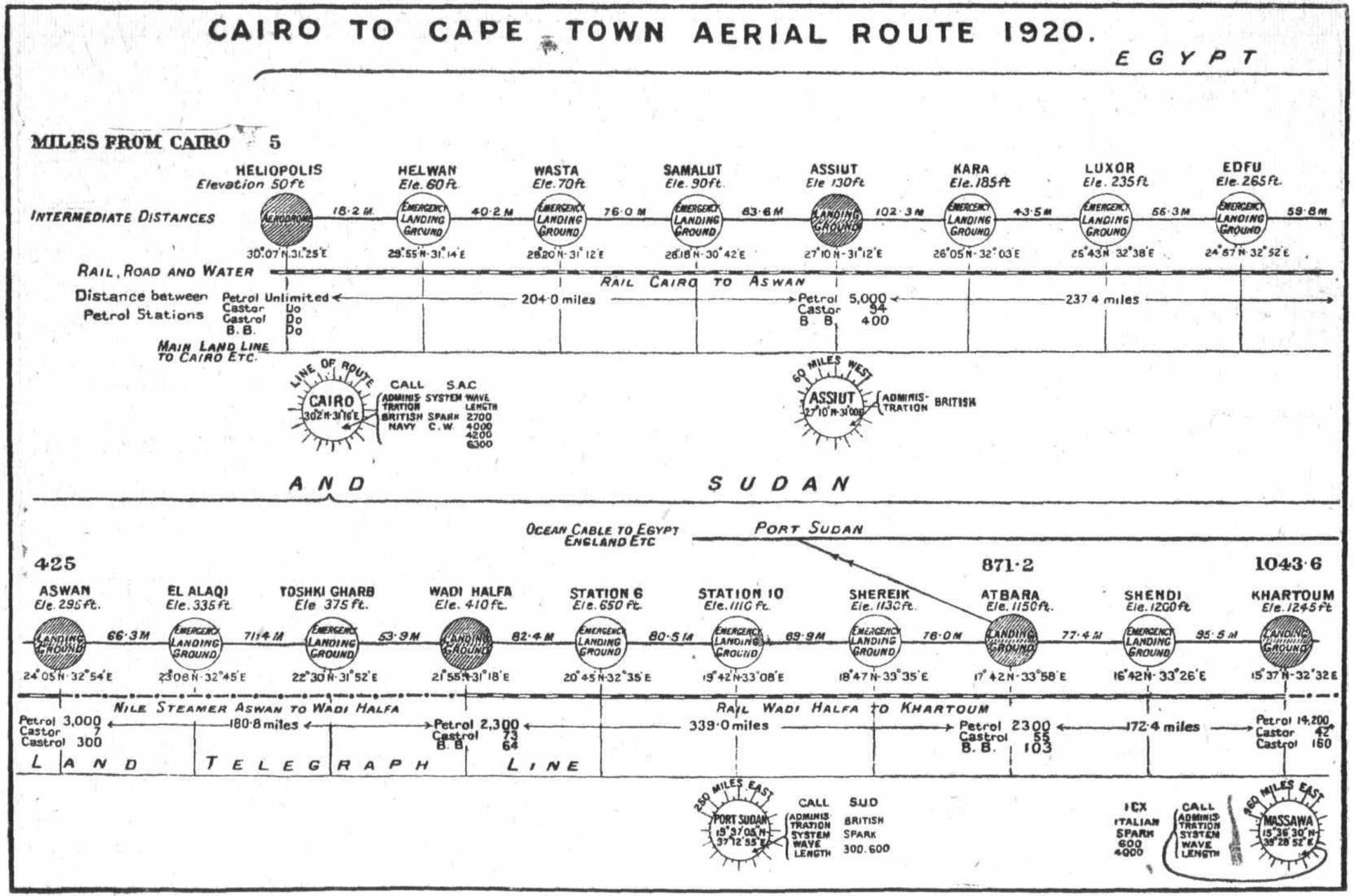
FURTHER information is now available regarding the Cairo-Cape Air Route which, as previously stated, is sufficiently organised for flying purposes.

Beyond the survey, clearance and general preparation of landing grounds, and the storage of petrol and oil at the most convenient stopping places, or what might be called "local facilities," certain arrangements have been made to assist the execution of the Cairo to Cape flight.

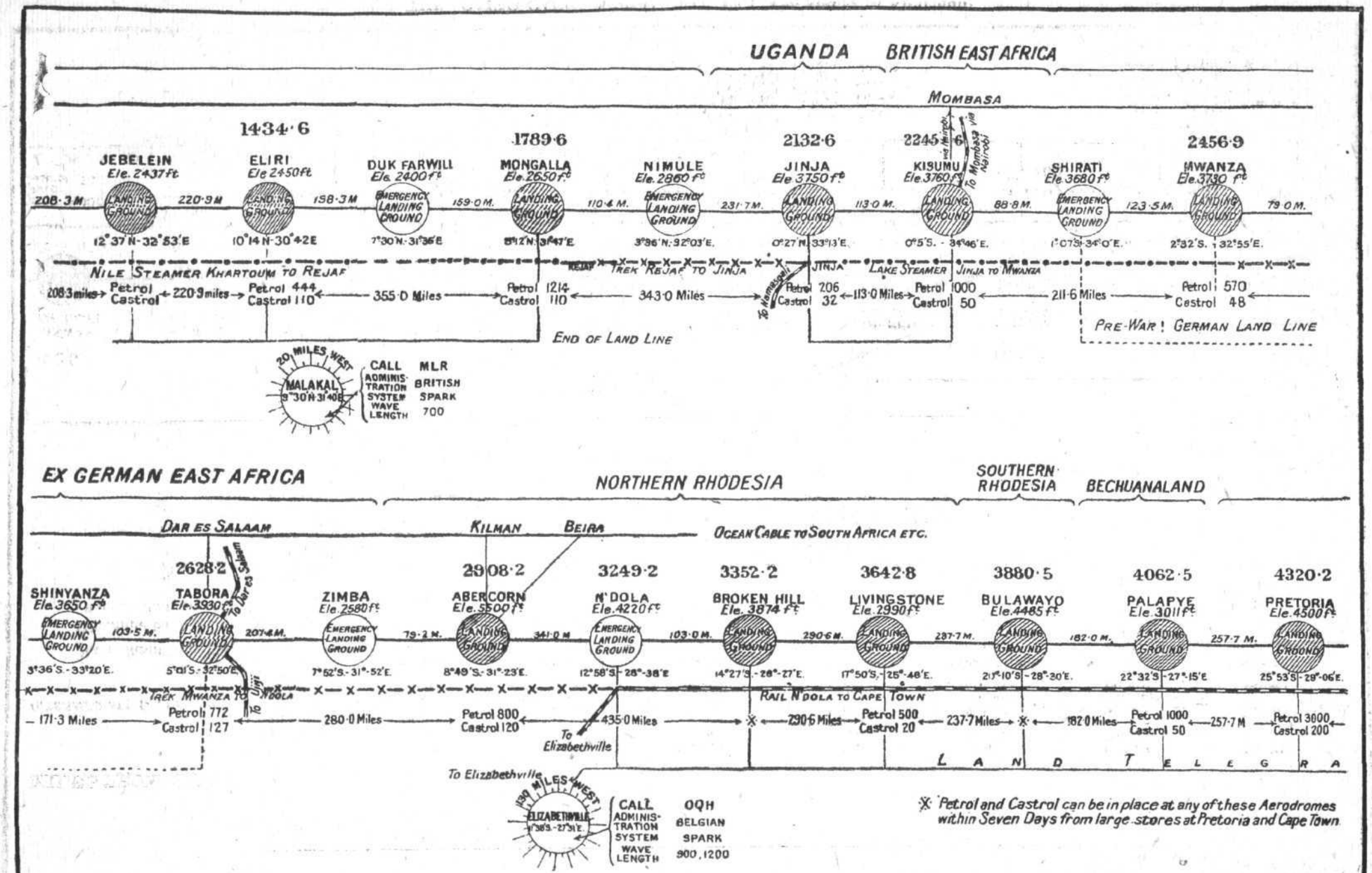
Each competitor has been furnished with elaborate route directions for the journey, comprising information as to the prevailing winds and weather conditions at various points; description of any conspicuous landmarks such as may enable the aerodrome to be more readily located; of all obstacles, and of the nature of the country surrounding each landing ground; and the distance and location from each aerodrome of the nearest railway, telegraph, doctor or hospital, drinking-water supplies, etc. He has also been supplied with a diagrammatic weather chart prepared by the Meteorological Section of the Air Ministry, after special investigation of the prevailing weather conditions along the route, showing the normal type of weather to be expected during the different seasons of the year. Moreover, so far as



LONDON–CAIRO–CAPE BY AIR: Group of the pilots and others directly concerned with this historical flight. Left to right: Mr. Corbett (*The Times*), Mr. Corby (rigger), Sergt-Maj. Wyatt (mechanic), Mr. A. Knight (works manager), Capt. Broome, D.F.C. (navigator and second pilot), Mr. R. K. Dowson (Vickers, South Africa), Capt. Cockerell, Croix de Guerre, Belgium (pilot), Mr. R. K. Pierson (designer of the "Vimy"), Mr. P. Muller (works superintendent)

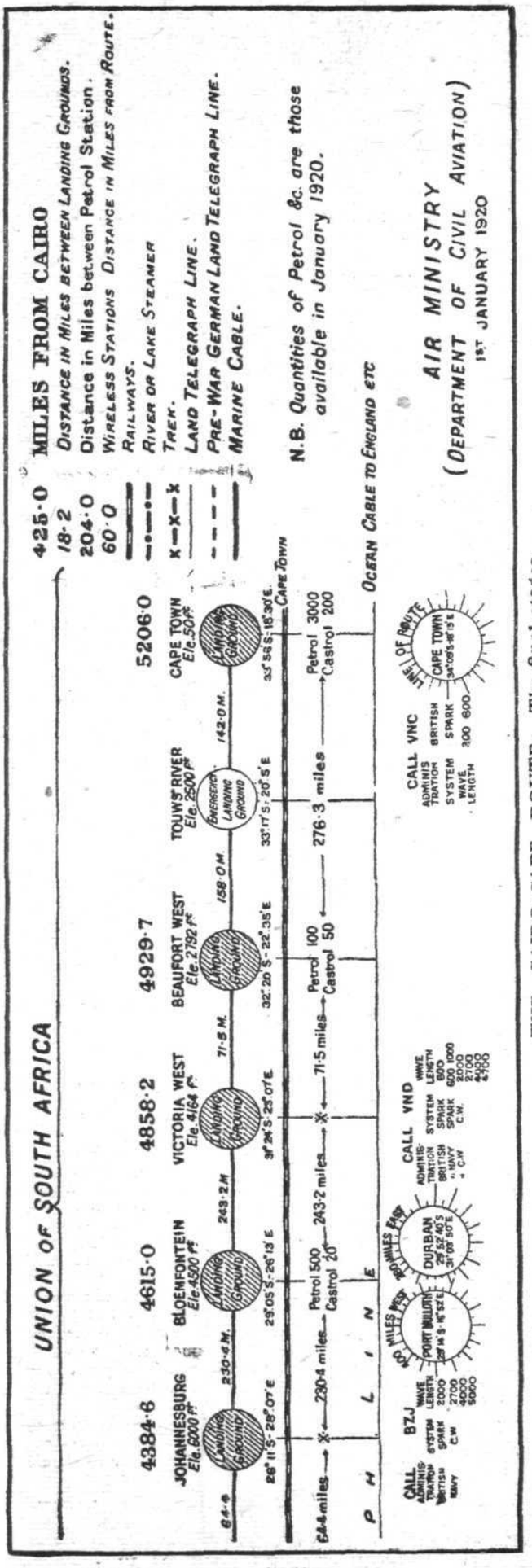


THE CAIRO-CAPE AERIAL ROUTE: The stages to Khartoum



THE CAIRO-CAPE AERIAL ROUTE: From Khartoum to Pretoria

FLIGHT
FEBRUARY 5, 1920



is possible, pilots will, during the progress of the journey, receive reports of the actual weather conditions ahead of them. (A copy of this chart is reproduced herewith.)

Customs clearance may be carried out by competitors at their home aerodromes instead of Hounslow, as is usual. The French Government is co-operating in this matter and has, as a special concession, waived the necessity for the usual compulsory halt for Customs examination at Le Bourget aerodrome, so that flights may be made without stopping at Lyons. In order that competing pilots shall be able to report progress with the least possible delay and keep in touch with their respective firms, special facilities for the dispatch of priority messages by cable and land line have been granted.

The diagrammatic route chart and the attached tabular statement give further details.

Distances and Facilities

Aerodrome.	Map location.	Miles from last preceding aerodrome.	Altitude feet.	Stores. P Petrol. O Oil. W Water	Communication (distance in miles): R = Rail Ro = Road. T = Telegraph S = Steamer. Tp = Telephone
EGYPT.					
Heliopolis* ..	30.07 N., 31.25 E.	—	50	P.O.W.	R., Ro., T.
Helouan* ..	29.55 N., 31.14 E.	18·2	60	P.O.W.	R., Ro., T.
Wasta	29.20 N., 31.12 E.	40·2	70	W.	R., T. (6 m.)
Samamut ..	28.18 N., 30.42 E.	76·0	90	W. (4)	R., T. (7 m.)
Assiut	27.10 N., 31.12 E.	83·6	130	P.O.W.	R. (2 m.), T. (6 m.)
Kara	26.05 N., 23.03 E.	102·3	185	W.	R., T.
Luxor	25.43 N., 32.38 E.	43·5	235	W.	R., T. (6 m.)
Edfu	24.57 N., 32.52 E.	55·3	265	W.	R., T.
Assouan† ..	24.05 N., 32.54 E.	59·8	295	P.O.W.	R., T.
El Aiaqui ..	23.08 N., 32.45 E.	66·3	335	W.	T., S.‡
Toshki Gharb ..	22.30 N., 31.52 E.	71·4	375	W.	T., S.‡
SOUDAN.					
Wadi Halfa ..	21.55 N., 31.18 E.	53·9	410	P.O.W.	R., S., T.
Station 6 ..	20.45 N., 32.35 E.	82·4	650	W.	R., T.
Station 10 ..	19.42 N., 33.08 E.	80·5	1,110	W.	R., T.
Shereik	18.47 N., 33.35 E.	69·9	1,130	W.	R. (3 m.)
Atbara	17.42 N., 33.58 E.	76·0	1,150	P.O.W.	R., T.
Shendi	16.42 N., 33.26 E.	74·4	1,200	W.	R. (2½ m.)
Khartoum† ..	15.37 N., 32.32 N.	5·5	1,245	P.O.W.	R., Ri., T.
Jebelein ..	12.37 N., 32.53 E.	208·3	2,437	P.O.W.	S.
Eliri	10.14 N., 30.42 E.	220·9	2,450	P.O.W.	T. (2 m.)
Duk Farwill ..	7.30 N., 31.36 E.	198·3	2,400	W.	T. (8 m.)
Mongalla ..	5.12 N., 31.47 E.	159·0	2,650	P.O.W.	T., W.
Nimule	3.36 N., 32.03 E.	110·4	2,860	?	T. (2 m.)
UGANDA.					
Jinja†	0.27 N., 33.13 E.	231·7	3,750	P.O.W.	S.
BR. S. AFRICA.					
Kisumu ..	0. 5 S., 34.46 E.	113·0	3,760	P.O.W.	R., S., T.
TANGANYIKA TERRITORY.					
Snirati	1.07 S., 34. 0 E.	88·8	3,680	W.	R., S., T.
Mwanza† ..	2.32 S., 32.55 E.	123·5	2,730	P.O.W.	S.
Shinyanza ..	3.36 S., 33.20 E.	79·0	3,650	?	S., T.
Tabora† ..	5.01 S., 32.50 E.	103·5	3,930	P.O.W.	R., T.
Zimba	7.52 S., 31.52 E.	207·4	2,580	W.	R., T.
N. RHODESIA.					
Abercorn ..	8,49 S., 31.23 E.	79·2	5,500	P.O.W.	T.
N'dola	12.58 S., 28.38 E.	336·0	4,220	W.	R., T. (1½ m.)
Broken Hill† ..	14.27 S., 28.27 E.	103·0	3,874	P.O.W.	R., T.
Livingstone ..	17.50 S., 25.48 E.	290·6	2,990	P.O.W.	R., T. (2½ m.)
S. RHODESIA.					
Bulawayo ..	20.10 S., 28.30 E.	237·6	4,485	P.O.W.	R. (1½ m.), T. (2½ m.)
BECHUANALAND.					
Palapwe ..	22.32 S., 27.15 E.	182·0	3,011	P.O.W.	R., T.
UNION OF S. AFRICA.					
Pretoria† ..	25.53 S., 29.06 E.	257·7	4,500	P.O.W.	R., T. (2 m.)
Johannesburg†	26.11 S., 28.07 E.	64·3	6,000	P.O.W.	R., T. (3 m.)
Blomfontein† ..	29.05 S., 26.13 E.	230·4	4,500	P.O.W.	R., T. (2½ m.)
Victoria, West†	31.24 S., 23.07 E.	243·2	4,164	P.O.W.	R., T (1 m.)
Beaufort, West†	32.20 S., 22.35 E.	71·5	2,792	P.O.W.	R., T. (2½ m.)
Touws River ..	33.17 S., 20. 5 E.	158·0	2,500	P.O.W.	R., T. (2 m.)
Cape Town† ..	33.56 S., 18.30 E.	142·0	50	P.O.W.	R., T. (1 m.)

Accommodation is available only at points marked —
* For machines and personnel. † For personnel.
‡ Rail at Wadi Halfa.

THE VICKERS FLIGHT

SOME details are now available concerning the flight of the Vickers-Vimy-Rolls commercial biplane which left Brooklands on January 24. With the assistance of the Air Ministry, and the co-operation of Messrs. Vickers, Ltd., *The Times*, on the initiative of Lord Northcliffe, have arranged for the machine to fly over the "all-red" route from Cairo to the Cape. The flight, besides testing the practical utility of the air route, will be in the nature of a definite scientific exploration. To this end Dr. Peter Chalmers Mitchell, C.B.E., D.Sc., LL.D., F.R.S., a member of *The Times* staff, and for many years secretary of the Zoological Society, will be on the machine during its flight across Africa. The crew of the machine consists of Capt. S. Cockerell (pilot), Capt. F. C. Broome, D.F.C. (pilot), Sergt.-Maj. James Wyatt, M.S.M.

(mechanic), Mr. C. Corby (rigger). The Vickers-Vimy machine is similar to that used by the late Sir John Alcock for the Transatlantic flight and by Sir Ross Smith for his flight to Australia; it is fitted with two Rolls-Royce "Eagle" engines, Mark VIII of 350 h.p. Dr. Mitchell will carry an autograph letter from His Majesty the King to the Governor-General of South Africa, and will make zoological and other scientific observations during the course of the journey.

Lord Cromer, Assistant Private Secretary to the King, in sending the King's letter to Dr. Mitchell, writes as follows:—

"I am sending you herewith an autograph letter that the King has written to the Governor-General of South Africa, and which His Majesty is pleased to entrust to Dr. Chalmers Mitchell to be conveyed by aeroplane from Cairo to the Cape.

"His Majesty hopes that all success may attend Dr. Chalmers Mitchell and the crew of the aeroplane in this the first attempt to be made by aircraft to traverse the Continent of Africa."

The machine called at Istres Aerodrome, near Marseilles, on January 27; on its way to Rome. The journey from Rome to Malta was made in 4 hrs. 50 min., while the next stage to Tripoli, which was made on January 30, took 2 hrs. 10 min. On February 1 it was reported at Benghazi on the Barbary Coast about 400 miles from Tripoli and 750 miles to Cairo, and it reached Cairo on February 3.

CAIRO-CAPE TOWN AERIAL ROUTE
CLIMATIC CHART

GOOD. — *Less than 30% of days of Rain, Fog, Gales or Thunderstorms.*

MODERATE. — *30%–60% of days of Rain, Fog, Gales or Thunderstorms*

BAD — *More than 60% of days of Rain, Fog, Gales or Thunderstorms*

LOCALITIES	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Cairo												
Assuan												
Khartoum												
Kodok												
Mongalla												
Jinja												
Mwanza												
Kitua												
Broken Hill												
Livingstone												
Bulawayo												
Pretoria												
Bloemfontein												
Cape Town												

THE ROYAL AERO CLUB OF THE U.K.

OFFICIAL NOTICES TO MEMBERS

"DAILY EXPRESS" £10,000 PRIZE

Flight from Great Britain to India and Back

(Under the Competition Rules of the Royal Aero Club and the Regulations of the Fédération Aéronautique Internationale)

RULES

1. The Proprietors of the *Daily Express* offer a Prize of £10,000 for the entrant who first succeeds under the subjoined conditions in carrying by air a cargo of 1,200 lbs. from Great Britain to India and back.

2. The Competition is open to persons of any nationality holding a licence issued by any Aero Club affiliated with the Federation Aeronautique Internationale.

3. The Competition shall be conducted by the Royal Aero Club under the Competition Rules of the Royal Aero Club and the Regulations of the Federation Aeronautique Internationale.

4. The flight must be accomplished between May 1, 1920, and October 31, 1920, both days inclusive.

5. The time occupied on either the outward or homeward journey is not to exceed 288 hours, and the homeward journey must be commenced within 15 days of the arrival in India.

6. (*a*) The cargo may be carried in one aircraft or may be distributed between not more than two aircraft.

(*b*) Aircraft may be changed *en route* provided that all aircraft used by any one entrant are identified with one firm of aircraft constructors.

(*c*) The entrant must declare what types of aircraft will be used by him, and the Royal Aero Club, whose decision shall be final, shall decide whether such aircraft are in conformity with clause (*b*) hereof.

(*d*) The term "Aircraft" for the purposes of this Competition includes Aeroplanes, Seaplanes, and Airships.

7. (*a*) The crew must not be changed during the Competition.

(*b*) More than one member of the crew may be a pilot and act as such if required.

(*c*) Names of the crew must be given to the Royal Aero Club not less than 14 days prior to the start.

8. The selection and provision of the cargo of 1,200 lbs. are left to the entrant. No alteration in the outward or homeward cargo is permitted *en route*.

9. The start from and arrival back in Great Britain must be at an Air Station licensed for foreign travel.

10. Karachi is the control and turning point in India.

11. On the outward journey the time will be taken from the moment of leaving the land or water at an Air Station in Great Britain licensed for foreign travel until the arrival on land or water at Karachi, India. On the homeward journey the time will be taken from the moment of leaving land or water at Karachi until the arrival on land or water in Great Britain at an Air Station licensed for foreign travel.

12. The start from Great Britain and from Karachi must be made under the supervision of officials appointed by the Royal Aero Club.

13. Competitors must conform to the Convention relating to International Air Navigation.

14. The Entry Fee is £100. This fee, together with the Entry Form, must be received by the Royal Aero Club, 3, Clifford Street, London, W.1, at least fourteen days before the start.

General

1. A competitor, by entering, thereby agrees that he is bound by the Regulations herein contained or to be hereafter issued in connection with this competition.

2. The interpretation of these regulations or of any to be hereafter issued shall rest entirely with the Royal Aero Club.

3. The competitor shall be solely responsible to the officials for the due observance of these regulations, and shall be the person with whom the officials will deal in respect thereof, or of any other question arising out of this competition.

4. A competitor, by entering, waives any right of action against the Royal Aero Club or the Proprietors of the *Daily Express* for any damages sustained by him in consequence of any act or omission on the part of the officials of the Royal Aero Club or the Proprietors of the *Daily Express* or their representatives or servants or any fellow competitor.

5. The aircraft shall at all times be at the risk in all respects of the competitor, who shall be deemed by entry to agree to waive all claim for injury either to himself, or his passenger, or his aircraft, or his employees or workmen, and to assume all liability for damage to third parties or their property, and to indemnify the Royal Aero Club and the Proprietors of the *Daily Express* in respect thereof.

6. The Committee of the Royal Aero Club reserves to itself the right, with the consent of the Proprietors of the *Daily Express*, to add to, amend or omit any of these rules should it think fit.

Copies of the entry form can be obtained from the Secretary of the Royal Aero Club.

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

THE PRINCIPLES OF RIGID AIRSHIP CONSTRUCTION

BY A. P. COLE, R.C.N.C., A.M.Inst.N.A.

(*Continued from page* 133.)

Structural Strength of the Ship

THE following remarks will apply particularly to the type of rigid airship known as the Zeppelin or Schutte-Lanz, *i.e.*, when the structure is built up of a number of longitudinal girders running throughout the ship, connected at intervals by transverse girders forming a frame round the ship (Fig. 2). This scheme of construction has been found to give the lightest ship, and to be most readily adaptable to use in very large ships. Considering first the ship as a whole: At any section there will be a bending moment and a shearing force in the vertical plane due to a combination of the static forces (*i.e.*, lift and weight) and aerodynamic forces (due to air pressure on the outer cover when the ship is running trimmed by the bow or the stern); and a bending moment and shearing force in the horizontal plane due to aerodynamic forces when turning. To meet these bending moments and shearing forces we have a built-up structure consisting of successive panels round the ship formed by the longitudinals and transverse girders, each panel being internally braced by wires, called diagonal wires (Fig. 3).

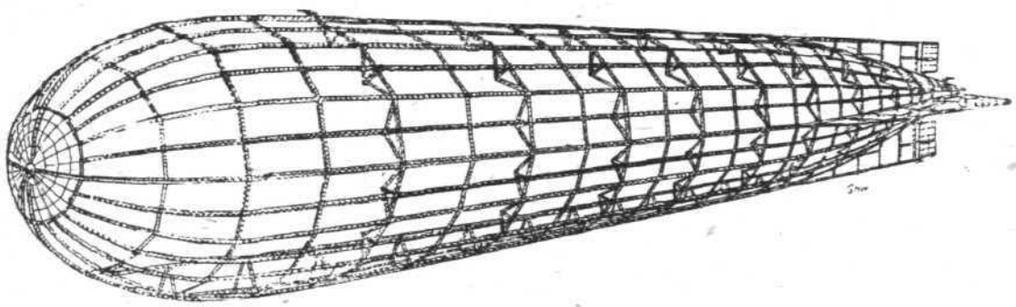


Fig. 2.—Skeleton structure of Zeppelin

It is assumed that the whole of the forces due to bending moment are taken by the longitudinal girders; the distribution of stress being according to the well-known beam formula

$$P = My/I,$$

y being measured from the neutral axis of the ship's section; I being measured by the product of the area of the continuous members of the longitudinal girders and the square of the distance of their centroid from the neutral axis of the ship.

For the purpose of this calculation, all continuous main longitudinal girders, including those in the corridor, are included.

The shearing force is assumed taken entirely by the diagonal wires. For the simple diagonal wire system, *i.e.*, with the wires being contained entirely in the one panel, it can be easily shown that the tensions in the wires which take the shearing force at a frame are given by the formula

$$\text{S.F.} \frac{L}{D} A \sin \phi / \Sigma A \sin^2 \phi$$

where S F = Shearing force at the frame.
L = Length of wire in the panel.
D = Length of side of transverse frame.
A = Area of cross section of diagonal wire.
ϕ = Angle which panel containing the wire makes with the horizontal plane.

The summation Σ is taken over the whole section.

Obviously at any one section, only the wires running in one direction will be stressed, while those in the opposite direction will tend to become slack. The wires which will be in tension can be readily ascertained from the sign and slope of the shearing force in the shearing force diagram.

In addition to these stresses due to being a part of the ship's structure, the longitudinals are subjected to lateral loads due to the gas pressure. Each longitudinal is assumed to take the gas pressure on a panel of width on either side of the longitudinal equal to half the spacing of the longitudinal girders from each other. The gas pressure is obtained from the formula—

Pressure in kilograms per sq. metre =
maximum blowing off pressure of automatic valve in mm. water above atmosphere
+ (height of base of longitudinal above automatic valve in metres) × 1·09.

The pressure obtained from this formula is the maximum that can be obtained in practice, and corresponds to the ship rising rapidly near the ground. Further the pressure of the air on the outer cover due to motion is, in general, in the opposite direction to the gas pressure, and consequently tends to diminish the lateral load. Hence the stress obtained from the combination of the end load and lateral load as calculated above is in general the highest that can occur in flight.

The maximum lateral load will occur on the top longitudinals. It is, therefore, extremely desirable that the top longitudinals should be in tension rather than compression. *Hence the distribution of loads should be such that the static bending moment at any section of the ship in all conditions should be hogging, i.e.,* tending to put the top longitudinals in tension. This principle, incidentally, is also used in some types of semi-rigids, the top longitudinals being replaced by fabric, which is thus always in tension.

With a view to decreasing the lateral load on those longitudinals which in addition have to take an end load due to the bending moment on the ship, in R 33 and similar ships intermediate longitudinals have been fitted. The end connections of these intermediate longitudinals are so arranged that the lateral load is transferred to the main frames, whilst practically no end load comes on the longitudinals.

The stresses in the main longitudinals are obtained from the generalised equation of three moments, assuming that each girder is continuous throughout the ship, and that the deflection at each transverse frame is zero. The necessary conditions for obtaining the bending moment are obtained by assuming that in the parallel body the slope of the girder at the transverse frame is zero.

(*To be continued.*)

WITH one thing and another it would appear as if *somebody* in the higher realms of our Government is inclined to sit up and take notice of aviation and its future. There is even an inclination not to cut down the Air Force Estimates so drastically as was originally foreshadowed. So there may be hope for the Empire yet.

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THAT the job will ultimately eventuate successfully there can be no manner of doubt, as private enterprise will somehow or another carry the missionary work through on its own shoulders, should our "Government" fail to respond to its responsibilities in providing for the protection of the Empire. And then they'll shout—the Jacks in office—and acclaim what a wonderful set of foreseeing men they be. But with the constant digs and warnings emanating from every side of thought, it seems hardly possible that such false economy can prevail for much longer. The responsibility for the results nationally would be too much even for our present autocratic incompetents to shoulder. Gen. Sykes, by his very able lecture before the Royal Geographical Society, has given a further incentive for prompt, progressive official action, and it may be hoped that before 1920 is out the powers that be will have realised in a practical form that it is not only possible, at popular rates, to make no loss in running selected mail services, but that a handsome profit is available for further extension of this highly desirable speeding-up of inter-communication.

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AT the same time, merely by way of rubbing in the reasonable mail-rate idea which so far the Government does not appear to be willing to grasp, we would draw special attention to the announcement made by the Airco firm as to the lowering of air freight rates, as a result of experience already gained, between London and Paris. This service is employed by the Post Office for the transport of express mail matter, and including collection and delivery by motor van between aerodrome and city, and air transport between Hounslow and Le Bourget in 2¼ hours, the rate for a parcel weighing from 1 lb. to 10 lbs. is now 2*s*. 6*d*. per lb.; the scale for greater weights becomes lower. A consignment weighing 75 lbs. and over will, for example, be accepted at the reduced rate of 1*s*. 6*d*. per lb.

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WHEN will the ordinary letter mail be carried under like "express" conditions, as it easily can be, at 6*d*. or even 3*d*. per letter?

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"EVERY decade has had its doubting Thomas," said Maj.-Gen. Sir Frederick Sykes during the evening, at the Royal Geographical Society on Monday. He did not add that every decade had not its Holt Thomas!

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WITH the February issue of the *A.B.C.*, fares, times of departure and arrival by air routes are included in their proper place. Another milestone.

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IN Mr. Winston Churchill's recent outlined scheme for the reconstitution of the Territorial Force, he said, that as a result of the War there is no longer danger of invasion. The Englishman's home is safe, and a Territorial Force is not required for home defence. He did *not* say that one of the most important units in the proposed T.F. would be the R.A.F. section.

But then, perhaps he has forgotten his duality and that he is the "boss" of the R.A.F. At least, both his statement and his omission give food for grave reflection. If the Minister for the Air does not realise that so long as we have no adequate provision for protection from air attack, the Englishman's home is very far from safe, the sooner he quits that portion of his dual job the better for the country. The R.A.F. in any Territorial Force scheme should be, if anything, the most outstanding draft of all.

\- - -

D'ANNUNZIO has broken out badly again, and is "Fumeing" pretty viciously in support of his good or badly conceived patriotic ideas. At least, his new mood has definitely decided him to renounce participation in the Rome-Tokyo flight. Wonder whether it's most lucky for Rome or for Tokyo.

\- - -

DURING a lecture on the League of Nations last week at Lyndhurst Road Church, Hampstead, Dr. Horton pointed out the many difficulties in the way of the consummation of this ideal problem, and at the same time the opportunities that existed, if properly handled, of obtaining a settlement for future permanent world-peace. It was mainly a question of "policing" the world adequately, and in this the difficulty was the selection of the "magistrates to legislate and administer for the whole body of nations." This body must be not only the Council or Legislative Chamber for the world, but must also replace the militarism of the nations by an efficient police force, that could carry out the decisions of the Council. The writer added that it was a remarkable thing that the main arm of such a police force was presented to the world in the mastery of the air, and that what at one time appeared the most deadly instrument of destruction might yet prove to be the most potent instrument for preserving peace between the nations.

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JUST so. "It's so simple," yet if Britain through its "Government" is not careful, this potent instrument may well slip from our grasp.

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THE museum of the Royal United Service Institution in Whitehall now boasts a new War relic in the form of a propeller of the Zeppelin which was shot down by the *Agamemnon* at Salonika in 1916.

\- - -

IT's all very well to advocate sky-scrapers for London as the only solution for housing the ever-growing population, but how about when the next war opens with those thousands of bomb-laden war-planes punting about up above? It's "dug-outs" that'll be fashionable then—warm in winter, cool in summer, bomb-proof, fireproof and storm-proof, and, as one writer puts it, "a lovely roof garden on the ground!" Yes, if our "Government" do not lay themselves out for countering these little futurist attentions, most folk would think it more in harmony with their ideas that the housing plans should be fashioned rather upon burrowing lines than the reverse.

\- - -

RECENTLY the London County Council was asked to nominate 300 boys for admission to the R.A.F. as boy mechanics. Curiously applications for nominations fell much below the number estimated. Sixty-three candidates were nominated, of whom 47 presented themselves for examination and 32 passed.

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YET there should be good "sport" about for them, judging by a report of the doings of the boys attached to the R.A.F. School of Technical Training at Halton Camp, Wendover, last Monday night. Alleged shortage of rations was the excuse given for a raid by hundreds of these youngsters on the camp canteen. According to the story, on a pre-arranged signal the boys, who are between 16 and 18 years of age, assembled outside the canteen shortly after 7 o'clock, and after smashing the windows and breaking down the doors, swarmed into the building and helped themselves liberally to tins of fruit, jam, biscuits and cake.

An armed guard of about 30 men arrived with a number of non-commissioned officers, carrying pickaxe handles and other weapons. The non-commissioned officers made a spirited charge among the crowd of shouting boys and dispersed them.

Some 15 boys, it is stated, were placed under arrest.

Altogether sounds as if there were plenty of go in these future riders of the wind.

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WE observe that a column of gossip about the Underground Railway services appearing in the evening papers is signed with the initials "R. 34." Does this indicate a change of occupation on the part of one of the officers or crew of that famous airship who has given up aerial touring for travels beneath the metropolis? Well, variety is the spice of life.

\- - -

SEVERAL friends have been enquiring the reasons for which flying is officially prohibited over certain areas, as we announced in our last issue. We can only suggest that those interested should make a tour by car of the districts indicated and see for themselves. In fact, doubtless those really interested will have already done so for themselves.

FLIGHT

AIRCRAFT UNDERCARRIAGES

BY JOHN D. NORTH, F.R.AE.S., F.R.MET.SOC.

(*Concluded from page* 131.)

Tail Skid

So far the support of the tail has not been discussed. It has already been shown that if the maximum permissible landing load on the tail is taken to be equal to the maximum down load designed for in flight, a structurally symmetrical and economical *fuselage* will result. The tail support usually takes the form of a skid attached to the body with a swivelling fork, and sprung with rubber shock absorber. Variations are shown in Fig. 38. In many cases it is desirable to control the swivelling motion from the pilot's seat to facilitate steering when taxi-ing. The design of the shock absorbing mechanism is simple. The energy to be absorbed when landing in condition (2) (wheel and skid simultaneously) is known from considerations already set out, and it is merely essential that the area of the load-deflection diagram should be at least as great as this without exceeding the maximum permissible load. In certain cases difficulties arise where considerable deflection is required, as heavy side loads may be imposed on the skid structure when the skid projects far beyond the fork.

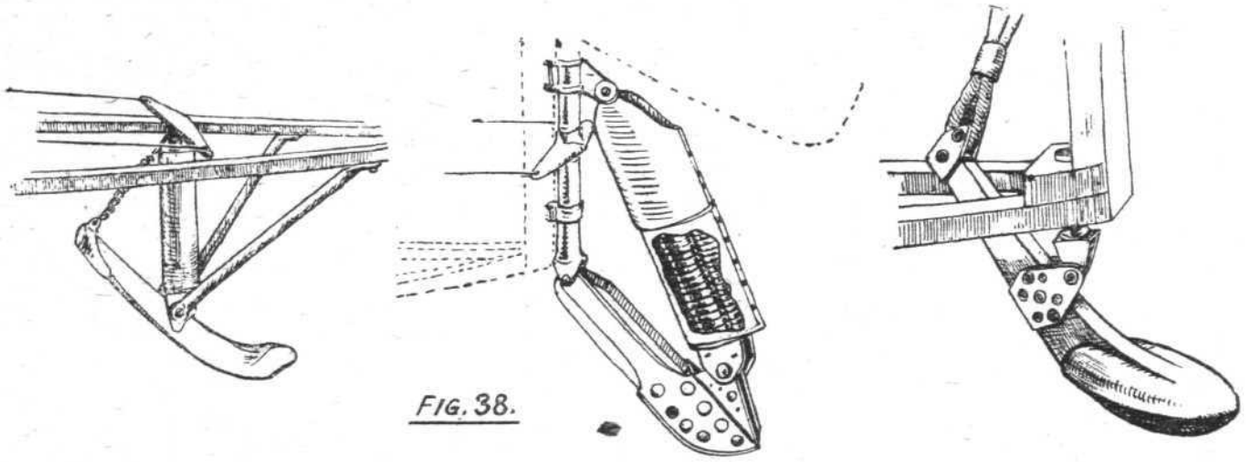


FIG. 38.

One of the important functions of the tail skid is to act as a brake, and in consequence the wear on the skid shoes is of great importance. The skid is usually heavily shod with high carbon or high manganese steel shoes of great hardness, but even these have rather a short life. In the case of twin-engined machines, which obviously do not require skid steering, the skid shoe is designed to have a low bearing pressure on the ground, and is preferably spoon-shaped. This has the effect of reducing side loads when the engines are used for turning. The use of heavy "sprags" on skids to give braking effect may set up big stresses in the *fuselage*, and consequently there is a limit to the braking effect to be obtained from the skid.

If the shock absorbing capacity of the whole undercarriage is to be improved considerably, more attention will have to be paid to the tail support. To a certain extent this has been done in the Braemar undercarriage, but it is by no means impossible that, in the case of large machines at least, wheel support—the practice of ten years ago—may be revived, and other means used for "braking" the aeroplane.

Brakes

An important feature of a "safe" aeroplane is its ability to land in a confined space, and, since low landing speeds have a definite aerodynamic disadvantage, the designer endeavours to ensure that the run after landing shall be reduced to a minimum.

The methods proposed for this are as follows :—

(1) Designing the machine to have a large angle to the horizon when at rest.

(2) Providing adjustable flaps, expanding rudders, etc., to act as air brakes.

(3) Reversing the propeller.

(4) Providing sprags or hooks on the tail skid.

(5) Ditto on the main undercarriage.

(6) Ditto brakes on wheels.

Of these methods (1) is probably the most successful, and has certain indirect advantages. Unfortunately it results in heavy tail-skid loads in normal design.

(2) has been repeatedly tried and abandoned, as the effect is negligible compared with (1).

(3) has been proposed but not yet successfully carried out; in any case it is not effective with the engine stopped.

(4) if carried to excess damages the landing ground, and is liable to put heavy stresses on the body which cannot be provided for accurately.

(5) is a common German practice, producing conditions not dissimilar to (4), but there is, as with (6), a tendency to turn the machine over on its nose, thus necessitating the use of leading wheels or skids. Experience has shown that the former are preferable.

The combination of (1) and (4) on small machines, and (1) and (6) on large machines seems to be the general trend of development.

In arranging for wheel brakes, special difficulties may be met with in the mechanical design owing to the heavy torque loads set up. The "Braemar" undercarriage has been designed to overcome the difficulties associated with wheel braking.

The calculation of the forces and moments arising from fitting wheel brakes is straightforward, and need not be gone into here. It is noteworthy, however, that the machine must be held in the stalled attitude in order that in the first part of the run advantage may be taken of the maximum air resistance at the comparatively high speed of travel. It will probably be found advisable, therefore, to apply the brakes when the speed is somewhat diminished. In considering the design of "leading" wheel gear, it will be found on investigation that if this is to be of full value it must have adequate shock absorbing mechanism.

Oscillations after Landing

Apart from the question of reducing loads in the aeroplane structure by the landing gear it is desirable that all oscillations should be damped as much as possible. The general method of determining the rate of damping follows directly from the examples given above for the oleo gear, but it will be necessary to take account of the work done on the axle. Owing to the great uncertainty as to the true values of hysteresis under actual conditions (referred to supra as "dynamic" hysteresis) no attempt has been made to follow up the example given with a quantitive determination of the damping of the oscillations. As a very rough approximation it is estimated that for the oleo gear with elastic and tyres, which has been discussed, the energy dissipated in the first oscillation would be somewhat as follows :—

Complete Undercarriage (*i.e.*, **Two Wheels**)

Total kinetic energy of aeroplane (vertical velocity 12 ft./sec.) = 201,200-in. lbs.

	inch lbs.
Work on elastic	70,000
,, oleo	64,000
,, tyres	57,600
,, axle	10,000

Energy dissipated.	Down stroke.	Up stroke.
Axle	not known—neglected	
Elastic	negligible	
Oleo	64,000	28,000
Wheels	11,500	

Total energy dissipated = 103,500 inch lbs.
= 51 per cent.

This corresponds to a free drop of 2·24 ft. and a rebound to 1·05 ft. The damping after the first oscillation is naturally less owing to the lower piston speed in the oleo gear.

It is distinctly shown that the rebound energy largely comes from the tyre. Capt. Barnwell has suggested to me the use of solid tyres, and there certainly seems to be a possibility of development in this direction. It must be borne in mind, however, that the tyre is called upon to absorb the kinetic energy of the wheel, and the tyre and axle that of the moving parts of the undercarriage, hence a definite shock absorbing capacity is required. At the same time the distribution of stress on the wheel is not so good as with a pneumatic tyre, and considerable increase in wheel weight may be expected with solid tyres.

Perhaps some form of cushion tyre may provide a satisfactory solution of the difficulty.

Taxi-ing—Periodic Oscillations

Oscillations set up due to taxi-ing on uneven ground may of course be estimated on an assumed ground condition. These oscillations may be very serious, and if the period of the machine coincides with the "ridge and furrow" pitch an undercarriage might easily be broken. This is, of course, obviated by changing the taxi-ing speed. Shock absorbing in taxi-ing must be considered, and defects such as rolling, excessive bouncing, or hard running may occur with an undercarriage which is quite efficient for landing.

Landing on One Wheel

Before attempting to draw deductions from the evidence submitted, there is one more case of landing to be dealt with, *i.e.*, landing on one wheel. In stressing an undercarriage for side load, it is usual to assume either that the C.G. of the machine is over the wheel in contact with the ground or that one wing tip is just touching the ground. Fig. 39 shows

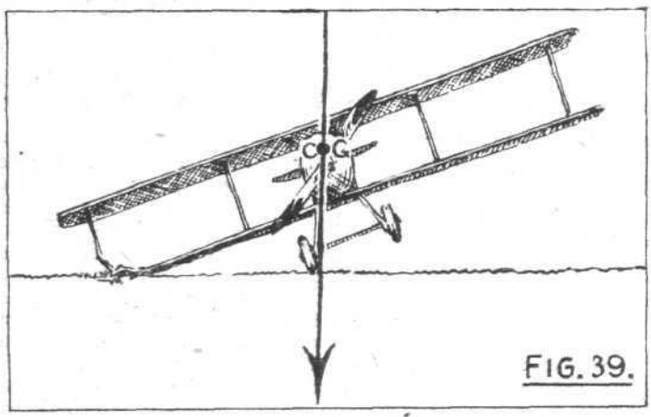


FIG. 39.

these conditions occurring simultaneously. An arbitrary load factor of two on the normal loads, with the machine resting in the position discussed, has been customarily used. This is not really satisfactory, and some breakages of undercarriages have occurred under side load which are difficult to explain. There is no doubt that the majority of the shock absorption falls on the tyre under these conditions, and considerable experimental data will be required for an investigation into the actual loads induced in the structure. It certainly seems likely that if a general improvement is to be made in undercarriages a definite capacity for absorbing side shock will have to be provided.

Wheel Position

To reduce "bucking" the wheels should be as nearly as possible under the C.G. of the aeroplane when the thrust line is horizontal, thus necessitating the use of leading wheels. The introduction of leading wheels permits the use of brakes, and when provided with proper shock absorbing mechanism will protect the machine against turning over as a result of striking obstacles on bad ground. The load on the tail is also relieved.

To reduce side loads and the danger of turning over sideways, the wheels should have a wide track. This helps to overcome the difficulty introduced by the change of wheel inclination due to big movement. It is clear that a really efficient undercarriage will be heavier and offer more resistance than the elementary types in use, but probably this increase would not be excessive.

* * * * *

On examining the evidence set out above, one is particularly struck with the large amount of additional data necessary before satisfactory conclusions can be reached. I have drawn as far as possible on such sources of information as were available to me, and while another six months' work would undoubtedly have enabled me to present a more complete set of results, I felt that probably the discussion following this paper would achieve the same object in a more rapid manner, and that at the same time many people might be sufficiently interested to extend the work already done. I feel sure that there are many untapped sources of information, and I hope that the admittedly controversial nature of this paper may result in disclosing some of these.

SUMMARY AND CONCLUSIONS

The following points seem to be indicated, though not of course in any way conclusively.

1. Wheels and Tyres

Wheel "strain energy" is negligible.

Shock absorbing capacity increases with rate of loading.

Energy dissipated ("hysteresis") increases with rate of loading.

The value of "static"/"dynamic" absorbing capacity ratio, as deduced from the Palmer Tyre Co. tests, ranges from 72 per cent. for a 1-ft. drop to 95 per cent. for a 6-ft. drop. The value of the same ratio obtained from C.I.M. 744 is 70 per cent. There is considerable difference in method between the two sets of tests. From some special tests by the Palmer Co. it is deduced that the percentage dissipated out of the total energy absorbed in static and dynamic tests is as follows :—

(*a*) Static hysteresis .. .. .. 8 per cent.
(*b*) Dynamic hysteresis .. .. 20 per cent.

The dynamic cases correspond to actual conditions.

Solid Tyres

Solid or rather cushion tyres might possibly be used with advantage to reduce oscillations. They must have a shock-absorbing capacity capable of dealing with the kinetic energy of the moving parts of the undercarriage. Considerable increase of wheel weight is to be feared with this system.

2. Rubber Shock Absorbers

Even tensioning and consistent quality of material are important, and individual rings seem to give the best promise of fulfilling these requirements.

Shock absorbing capacity remains constant with varying rate of loading. Energy dissipated diminishes with rate of loading. (Boulton and Paul experiments.)

Mr. Turner states that with rates of loading corresponding to actual conditions any hysteresis of rubber shock absorber appears from preliminary experiments to be negligible. The details of these experiments are, however, not available.

Shock absorbing capacity decreases after repeated extensions.

Vertical Velocity.—Value of u is indeterminate, but should not be less than $V \sin \gamma$.

Load Factor.—Landing factor should be of the same order as flight factor.

Oleo Gear Design.—Since to get high shock absorbing capacity a big movement of the leg is required, only a small part of the piston movement should be coincident with movement of the rubber. With this condition the damping is increased. To take full advantage of the oleo gear, a relief valve is necessary, in addition to the constant leak holes, opening just before the maximum load on the structure is reached. The effect of using air cushions requires further investigation.

In order to get large travel certain obvious difficulties due to angular motion of struts, etc., have to be overcome. A large wheel base will assist this, and at the same time improve conditions for landing canted or side to wind. A large wheel base is also necessary with big travel to avoid "rolling" or swaying in taxi-ing.

Leading wheels have definite advantages, but must have a proper shock absorbing capacity.

The possible undercarriage arrangements are innumerable, but the advantages of various systems may be examined quantitively by the methods outlined. It is reasonable to expect that a considerable improvement can be made on present practice by a slight sacrifice of flight performance.

In conclusion I have to thank those who have so kindly furnished me with information and assistance in the preparation of this paper. Particularly Mr. Thomas Sloper and the Palmer Tyre Co., Ltd., for valued information and special experiments on tyres; Capt. F. S. Barnwell, B.Sc., F.R.Ae.S., and the Bristol Aeroplane Co., for details of the Braemar Gear; Capt. F. M. Green, A.M.I.C.E., F.R.Ae.S., and the Siddeley-Deasy Co., Ltd., for details of the Siskin Gear; Mr. Turner, of Luke Turner and Co., for information dealing with rubber shock absorbers. The Director of Research, for permission to quote several confidential information memoranda. My assistant engineers, Mr. O. Glauert, B.A., for the work on the complete Oleo Gear Analysis; and Mr. H. J.

Pollard, Wh.Ex., A.F.R.Ae.S., for the preparation of the stress diagrams.

APPENDIX

An aeroplane of weight 7,500 lbs. strikes the ground with a vertical velocity of 12 ft. for a second. To find how the energy is absorbed by the wheels, elastic and oleo gear.

With the notation in the text.

Original $T_c = 1{,}400$ lbs.
$W = 7{,}300$ lbs.
$w = 200$ lbs.

When $P' = o\,P = \frac{7{,}500}{7{,}300} \times 1{,}400 = 1{,}440$.

Hence tyre deflection = o·9-in.
work done = 600-in. lbs. } from graph.

Half energy of aeroplane = 100,600-in. lbs.
$= 699\ V^2$

$$V_1^2 - V_2^2 = \frac{600}{699} = o \cdot 86$$
$$\therefore\ V_2^2 = 143 \cdot 14$$
$$V_2 = 11 \cdot 96$$

Table 1. $u > \frac{1}{2}V$.

dz is chosen arbitrarily. P is the average value in the interval dz.
From a first calculation the average value x in the interval dz is determined and the value of T_c for this mean x is taken.
The initial value of u_2^2 and V_2^2 is 143·14.
To determine ϕ an average value of V/u is taken.

Stage 1. $u > \frac{1}{2}V$.

x in.	dz in.	$av \cdot x$ in.	P lbs.	T_c lbs.	$\frac{\rho A}{362\,(v-u)^2}$	ψ $(P - T_c - \rho A)\,dz$	$\psi \div 18 \cdot 05$ $u_1^2 - u_2^2$	u_2^2	u_2	$\frac{V}{u}$	ϕ $\frac{V}{u}(T_c + \rho A)\,dz$	$V_1^2 - V_2^2$ $\phi \div 680$	V_2^2	V_2	$V_2 - u_2$	$\frac{V_2 - u_2}{u_2}$	dx
								143·14					143·14				
0·9	0·5	·01	1,980	1,430	40	255	13·66	129·48	11·38	1·047	750	1·11	142·03	11·92	0·54	·047	·024
1·4	0·2	·03	2,800	1,460	250	218	11·69	117·79	10·85	1·096	370	0·54	141·49	11·89	1·04	·096	·019
1·6	0·2	·06	3,300	1,520	700	216	11·58	106·21	10·31	1·150	500	0·74	140·75	11·86	1·55	·150	·030
1·8	0·2	·08	3,800	1,560	1,170	214	11·48	94·73	9·73	1·215	650	0·95	139·80	11·82	2·09	·215	·043
2·0	0·2	·14	4,320	1,670	1,830	164	8·80	85·93	9·27	1·270	870	1·29	138·51	11·77	2·50	·270	·054
2·2	0·2	·20	4,830	1,800	2,470	112	6·00	79·93	8·94	1·309	1,111	1·63	136·88	11·70	2·76	·300	·061
2·4	0·2	·27	5,340	1,940	2,980	84	4·50	75·43	8·68	1·340	1,305	1·92	134·96	11·62	2·94	·340	·068
2·6	0·2	·34	5,850	2,080	3,430	68	3·64	71·79	8·47	1·360	1,500	2·20	132·76	11·52	3·05	·360	·072
2·8	0·2	·41	6,370	2,200	3,570	116	6·22	65·57	8·10	1·410	1,620	2·37	130·39	11·42	3·32	·410	·082
3·0	0·2	·50	6,860	2,340	4,280	48	2·57	63·00	7·94	1·424	1,890	2·78	127·60	11·30	3·36	·424	·085
3·2	0·2	·59	7,380	2,420	4,430	106	5·68	57·32	7·57	1·474	2,020	2·96	124·64	11·16	3·59	·474	·095
3·4	0·2	·68	7,890	2,570	4,900	72	3·85	53·47	7·31	1·506	2,290	3·36	121·28	11·01	3·70	·506	·101
3·6	0·2	·79	8,400	2,680	4,900	164	8·84	44·63	6·68	1·625	2,460	3·62	117·64	10·85	4·17	·625	·125
3·8	0·2	·95	8,900	2,810	4,900	238	12·75	31·88	5·65	1·888	2,730	4·01	113·63	10·66	5·01	·888	·178

Table 2. $u > \frac{1}{2}V$.

dz is chosen arbitrarily and a value for a mean $u/V - u$ over the period was guessed. Mean values of P and T_c were taken throughout. The method was very tedious, especially in the later stages, when as many as five approximations were made on occasions to establish a satisfactory mean.

Stage 2. $u < \frac{1}{2}V$.

x in.	dz	$\frac{u}{V-u}$	P lbs.	T_c lbs.	$\frac{\rho A}{\text{const. at first}}$	ψ $\frac{u}{V-u}(P - T_c - PA)\,dx$	$u_1^2 - u_2^2$ $\psi \div 18 \cdot 65$	u_2^2	u_2	$\frac{V}{V-u}$	ϕ $\frac{V}{V-u}(T_c + \rho A)\,dx$	$V_1^2 - V_2^2$ $\phi \div 680$	V_2^2	V_2	$V_2 - u_2$	$\frac{u_2}{V-u}\,dx$	z
								31·88					113·63				
1·04	0·2	·688	9,300	2,980	4,900	256	13·70	18·18	4·24	1·688	2,970	4·37	109·25	10·45	6·21	·180	4·18
1·24	0·2	·432	9,040	3,060	4,900	160	8·58	9·60	3·10	1·432	2,350	3·46	105·79	10·28	7·18	·086	4·27
1·44	0·2	·248	9,850	3,140	4,900	103	5·52	4·08	2·02	1·248	2,080	3·06	102·73	10·13	8·11	·050	4·32
1·64	0·2	·147	9,940	3,200	4,900	45	2·44	1·64	1·28	1·147	1,820	2·68	100·05	10·00	8·72	·029	4·35
1·84	0·2	·032	10,040	3,240	4,900	28	1·53	0·11	0·33	1·032	1,750	2·57	97·48	9·87	9·54	·006	4·35
2·04	0·2	—	10,050	3,300	4,900	6	0·32	—	—	1·000	1,670	2·45	95·03	9·75	9·75	—	4·35
2·24	0·36	negligible.	10,050	3,400	4,900	negligible.	negligible.	negligible.	negligible.	1·000	2,990	4·40	90·63	9·52	9·52	negligible.	4·35
2·60	1·0		10,050	3,660	4,900					1·000	8,560	12·59	78·04	8·83	8·83		4·35
3·60	1·0		10,050	4,200	4,900					1·000	9,100	13·38	64·66	8·04	8·04		4·35
4·60	1·0		10,050	5,060	4,900					1·000	9,960	14·66	50·00	7·07	7·07		4·35
5·60	0·2	·065	10,060	5,780	4,900	— 8·1	—0·43	0·43	0·66	1·066	2,240	3·29	46·71	6·83	6·17	·010	4·36
5·80	0·2	·150	10,060	6,050	4,900	—17·8	—0·95	1·38	1·17	1·150	2,520	3·70	43·01	6·56	5·39	·040	4·40
6·00	0·2	·580	10,100	6,380	4,900	—73·2	—3·93	5·31	2·30	1·580	2,940	4·31	38·70	6·22	3·92	·060	4·46
6·20	0·1	·760	10,200	6,700	4,400	—61	—3·26	8·57	2·93	1·760	1,950	2·77	35·93	5·99	3·50	·080	4·54
6·30	0·1	·910	10,500	6,900	3,410	+17	+0·93	7·64	2·76	1·910	1,970	2·90	33·03	5·75	2·99	·090	4·63
6·40	0·1	·840	10,700	7,000	3,390	26	1·40	6·24	2·50	1·840	1,910	2·81	30·22	5·50	3·06	·084	4·71
6·50	0·1	·755	10,900	7,200	3,390	31	1·66	4·58	2·14	1·755	1,860	2·73	27·49	5·24	3·06	·084	4·80
6·60	0·1	·655	11,200	7,400	3,460	22	1·19	3·39	1·84	1·655	1,800	2·64	24·85	4·99	3·15	·066	4·86
6·70	0·1	·562	11,320	7,600	3,500	12	0·66	2·73	1·65	1·562	1,735	2·55	22·30	4·72	3·07	·056	4·92
6·80	0·1	·490	11,480	7,820	3,390	13	0·71	2·02	1·42	1·490	1,670	2·46	19·84	4·45	3·03	·049	4·97
6·90	0·1	·422	11,600	8,040	3,320	10	0·54	1·48	1·22	1·422	1,610	2·37	17·47	4·18	2·96	·042	5·01
7·00	0·1	·374	11,700	8,300	3,130	10	0·54	0·94	0·97	1·374	1,570	2·31	15·16	3·89	2·92	·037	5·05
7·10	0·1	·309	11,780	8,540	2,980	8	0·42	0·52	0·72	1·309	1,505	2·21	12·95	3·60	2·88	·031	5·08
7·20	0·1	·229	11,840	8,800	2,860	4	0·32	0·30	0·55	1·229	1,435	2·11	10·84	3·29	2·74	·023	5·10
7·30	0·1	·163	11,880	9,080	2,640	2·6	0·14	0·16	0·40	1·163	1,365	2·00	8·84	2·97	2·57	·016	5·12
7·40	0·1	·115	11,900	9,360	2,320	2·5	0·13	0·03	0·17	1·115	1,300	1·91	6·93	2·63	2·46	·012	5·13
7·50	0·1	—	—	9,640	2,190	—	—	—	—	1·000	1,180	1·74	5·19	2·28	2·28	—	—

THE ROYAL AIR FORCE

London Gazette, January 20

Flying Branch

Sec. Lieut. (Hon. Lieut.) J. E. Radley relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain rank of Lieut.; Nov. 28, 1919.

The initials of Lieut. S. Y. Grant are as now described, and not as stated in *Gazette* April 25, 1919.

The initials of Sec. Lieut. J. N. Poole are as now described, and not as stated in *Gazette* Feb. 11, 1919.

The Christian names of Sec. Lieut. Robert Melbourne Fearman are as now described, and not as stated in *Gazette* April 25, 1919.

The surname of Lieut. E. D. C. Herne is as now described, and not as stated in *Gazette* March 28, 1919.

The surname of Sec. Lieut. R. Gilruth is as now described, and not as stated in *Gazette* April 15, 1919.

The surname of Sec. Lieut. J. Olorenshaw is as now described, and not as stated in *Gazette* April 29, 1919.

The notification in *Gazette* Sept. 30, 1919, concerning Capt. C. W. Baldwin is cancelled.

The notification in *Gazette* April 1, 1919, concerning Sec. Lieut. W. H. Brown is cancelled.

The notification in *Gazette* Nov. 7, 1919, concerning Sec. Lieut. P. J. Parry is cancelled.

The notification in *Gazette* Nov. 25, 1919, concerning Sec. Lieut. D. R. Bradley is cancelled, notification in *Gazette* Dec. 12, 1919, to stand.

Administrative Branch

Sec. Lieut. R. N. Lamb to be Lieut.; May 8, 1919 (since demobilised).

Pilot Officer H. Gambier to be Flying Officer; Dec. 10, 1919.

Sec. Lieut. J. R. Brown to be Sec. Lieut., from (O.); Oct. 12, 1918 (substituted for notification in *Gazette* Oct. 3, 1919).

Sec. Lieut. C. J. Richardson (late Gen. List, R.F.C., on prob.) is confirmed in rank as Sec. Lieut.; Dec. 4, 1918.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer H. Butler (Lieut., Dorset R.); Nov. 28, 1919. Flight-Lieut. F. F. Loyd (Capt., Sher. F.); Dec. 16, 1919. Flight-Lieut. P. Gadsby, O.B.E. (Capt., R.A.O.C.); Jan. 1.

Capt. F. Wilkinson (Capt., S. Staff. R.) relinquishes his commn. on ceasing to be employed; Feb. 18, 1919.

(Then follow the names of five officers who are transfd. to the Unemployed List under various dates.)

Lieut. A. E. Burrowes, M.C., relinquishes his commn. on account of ill-health (caused by wounds), and is granted the rank of Capt.; Jan. 14.

Sec. Lieut. (actg. Capt.) G. L. Grey relinquishes his commn. on account of ill-health (contracted on active service), and is permitted to retain the rank of Capt.; Jan. 18.

Sec. Lieut. J. E. West relinquishes his commn. on account of ill-health (contracted on active service), and is permitted to retain his rank; Jan. 13.

The surname of Sec. Lieut. Alfred Golding is as now described, and not as stated in the *Gazette* of May 13, 1919.

The notification in the *Gazette* of April 1, 1919, concerning Capt. F. Wilkinson is cancelled.

The notification in the *Gazette* of May 6, 1919, concerning Sec. Lieut. J. Mann is cancelled.

Technical Branch

Maj. S. Lambert is graded for purposes of pay and allowances as Capt. whilst employed as Capt., Grade (A.), from unemployed list; June 4, 1919.

Flying Officer F. Murphy, M.B.E., is graded for purposes of pay and allowances as Flight-Lieut. whilst employed as Flight-Lieut., Grade (A.); Sept. 16, 1919.

Sec. Lieut. R. A. Munday is graded for purposes of pay and allowances as Flight-Lieut. whilst employed as Flight-Lieut., Grade (A.), from May 1, 1919, to Nov. 4, 1919.

Flying Officer A. J. Somers to be Flying Officer, from (S.O.); Nov. 14, 1919.

Sec. Lieut. (Hon. Capt.) H. Gardiner to be Lieut.; April 2, 1918 (substituted for notification in the *Gazette* of April 11, 1919).

Sec. Lieut. S. Curzon to be Lieut., Grade (B.); Jan. 31, 1919.

Pilot Officers to be Flying Officers, Grade (B.):—A. J. Moore; Oct. 1, 1919. J. E. Betts; Dec. 13, 1919.

Sec. Lieut. G. F. Gregg to be Lieut., without pay and allowances of that rank; May 16, 1919.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer (Hon. Flight Lieut.) O. M. Greg (Capt., War. R. T.F.); Sept. 18, 1919 (substituted for notification in *Gazette* Oct. 24, 1919) Flight-Lieut. W. H. Day (Lieut. (Temp. Capt.), Hamps. R.); Nov. 26, 1919.

The following relinquish their commns. on ceasing to be employed:—Sec. Lieut. A. J. Gregson; Sept. 9, 1919. Wing Comdr. G. F. Montagu (Comdr., R.N.); Oct. 12, 1919 (substituted for notification in *Gazette* Oct. 28, 1919)

(Then follow the names of 20 officers who are transfd. to the Unemployed List under various dates.)

Capt. W. J. Mair relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Jan. 12.

Capt. E. Parker (3rd E. Lan. R., S.R.) relinquishes his commn. on account of ill-health contracted on active service; Jan. 8.

The initials of Sec. Lieut. (Hon. Lieut.) P. J. McChesney (Lieut., R. Fus.) are as now described, and not as stated in *Gazette* of April 8, 1919.

The surname of Capt. J. Matthew is as now described, and not as stated in the *Gazette* of April 25, 1919.

The notification in *Gazette* of Sept. 19, 1919, concerning Sec. Lieut. A. J. Gregson is cancelled.

Medical Branch

J. D. Keir (Surg.-Comdr., R.N.) is granted a temp. commn. as Lieut.-Col.; Oct. 1, 1918, with seniority from April 1, 1918 (substituted for the notification in the *Gazette* of Nov. 26, 1918).

Memoranda

(Then follow the names of 15 Overseas Cadets granted temp. commns. and six Cadets granted hon. commns. as Sec. Lieuts.)

The notification in the *Gazette* of June 13, 1919, concerning Maj. R. E. Childers, D.S.C., is cancelled.

London Gazette, January 23

Permanent Commissions

Flight-Lieut. A. E. Gendle, O.B.E. (T.), is granted a permanent commn. in the rank stated (Aug. 1, 1919), subject to learning to fly within twelve months.

Flying Officer M. P. S. Burger, D.F.C. (A.), resigns his permanent commn.; Jan. 24.

The following temporary appointment is made at the Air Ministry:—

Staff Officer, 2nd Class.—(Q.)—Capt. W. H. G. Maton, M.B.E.; March 19, 1919, and to be actg. Maj. while so employed till April 30, 1919 (substituted for notification in *Gazette* June 3, 1919).

Flying Branch

Sec. Lieut. W. A. Hammond to be Lieut.; March 26, 1919 (since demobilised).

Pilot Officers to be Flying Officers:—C. Taylor; Aug. 24, 1919. W. E. James (A'ship); Oct. 1, 1919.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer M. K. Parlee (Lieut., Saskatchewan R.), Pilot Officer (Hon. Flying Officer) F. F. McCullock, M.C. (Lieut., Sask. R.); March 31, 1919. Flying Officer O. W. Lingham (Lieut., Can. Cyclist Corps); April 6, 1919. Flight-Lieut. V. H. Houston, M.C. (Capt., Can. A.S.C.); Sept. 30, 1919. Sqdn. Ldr. R. E. Orton (Capt., E. Lan. R.); Nov. 4, 1919. Flight-Lieut. F. J. F. Lee (Capt., R. Muns. Fus.); Nov. 8, 1919. Flying Officer E. Littlejohn (Lieut., Norf. R.); Nov. 10, 1919. Flying Officer J. L. Head (Lieut., R. Suss. R.); Nov. 25, 1919. Flying Officer C. T. Smith (Lieut. North'd. Fus.); Nov. 26, 1919. Flying Officer L. H. Phelps (Lieut., Linc. R.); Nov. 30, 1919. Pilot Officer W. A. B. Buscarlet (Lieut., R.G.A.); Nov. 31, 1919. Flight-Lieut. D. J. Sheridan (Capt., R. Ir. Fus.); Dec. 2, 1919. Flying Officer A. Le G. Campbell (Lieut., High. L.I.), Flying Officer S. I. Thomas (Lieut., R.W. Fus.); Jan. 5. Flying Officer C. M. G. Horton (Lieut., R.F.A.), Flying Officer A. A. Ward (Lieut., R.F.A.); Jan. 7. Flying Officer R. I. MacPherson, A.F.C. (Lieut., Dorset R.); Jan. 12.

Maj. C. M. Murphy (Lieut.-Comdr., R.N.) relinquishes his commn. on ceasing to be employed; Aug. 19, 1919 (substituted for notification in *Gazette* Aug. 19, 1919).

(Then follow the names of 49 officers who are transfd. to the Unemployed List under various dates.)

Capt. P. G. Taylor resigns his commn. at own request, and is permitted to retain his rank; March 31, 1919 (substituted for notification in *Gazette* of April 15, 1919.

Lieut. C. T. Bremickar relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Jan. 2.

The following Sec. Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—T. G. Brooke (caused by wounds); Jan. 15. N. V. Scott (contracted on active service); Jan. 17.

Sec. Lieut. (Hon. Lieut.) A. Mills relinquishes his commn.; Feb. 12, 1919.

The surname of Maj. L. W. Learmount, D.S.O., M.C., is as now described, and not as stated in the *Gazette* of April 1, 1919.

The surname of Lieut. R. R. Ffolkes-Gill is as now described, and not as stated in the *Gazette* of April 1, 1919.

The surname of Lieut. W. Moet Lusby is as now described, and not as stated in the *Gazette* of April 15, 1919.

The surname of Lieut. L. C. Jarrett is as now described, and not as stated in the *Gazette* of May 2, 1919.

The surname of Sec. Lieut. F. Gouthro is as now described, and not as stated in the *Gazette* of April 15, 1919.

The initials of Lieut. A. W. F. Gouriet are as now described, and not as stated in the *Gazette* of April 29, 1919.

The initials of Sec. Lieut. W. F. Gordon are as now described, and not as stated in the *Gazette* of April 1, 1919.

The initials of Sec. Lieut. K. P. O. Evans are as now described, and not as stated in the *Gazette* of May 20, 1919.

The initials of Sec. Lieut. J. H. Pryce-Jones are as now described, and not as stated in the *Gazette* of Feb. 7, 1919.

The notification in the *Gazette* of Jan. 28, 1919, concerning Lieut. T. L. Green (R.F.A.) is cancelled.

The notification in the *Gazette* of Oct. 14, 1919, concerning Lieut. H. M. Taylor is cancelled.

The notification in the *Gazette* of Oct. 31, 1919, concerning Lieut. A. C. Collier is cancelled.

The notification in the *Gazette* of Dec. 23, 1919, concerning Lieut. H. G. Ross (Devon. R.E., T.F.) is cancelled. Notification in the *Gazette* of Dec. 31, 1918, to stand.

The notification in the *Gazette* of April 4, 1919, concerning Sec. Lieut. R. Baird is cancelled.

The notification in the *Gazette* of July 8, 1919, concerning Sec. Lieut. N. M. Harrison is cancelled. Notification in the *Gazette* of July 4, 1919, to stand.

The notification in the *Gazette* of April 1, 1919, concerning Sec. Lieut. Hon. Lieut.) A. Mills is cancelled.

The notification in the *Gazette* of July 15, 1919, concerning Sec. Lieut. (Hon. Lieut.) R. S. Cole is cancelled.

Administrative Branch

Sec. Lieut. C. J. Richardson to be Lieut.; Jan. 5, 1919.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer T. P. Keady (Temp. and Actg. Lieut. R.E.); Aug. 29, 1919. Flying Officer G. D'A. W. Oliver (Lieut., Wilts. R.); Dec. 1, 1919. Lieut. P. H. Drury (Lieut., S. Wales Bord.); Dec. 22, 1919.

(Then follow the names of 11 officers who are transfd. to the Unemployed List under various dates.)

Lieut. (actg. Maj.) W. Watson, M.B.E. (Lieut., A. Cyclist Corps, T.F.), relinquishes his commn. on account of ill-health; Jan. 8.

Sec. Lieut. N. R. Scully relinquishes his commn. on account of ill-health (contracted on active service), and is permitted to retain his rank; Jan. 8.

Technical Branch

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer (Hon. Flight-Lieut.) R. C. Morgan (Capt., Canadian F. Art.); March 31, 1919. Pilot Officer (Hon. Flying Officer) A. T. Thompson (Lieut., North'n. R.); Jan. 15.

(Then follow the names of 19 officers who are transfd. to the Unemployed List under various dates.)

Lieut. F. N. Shone (Lieut., S. Staffs. R.) resigns his commn., and is permitted to retain his rank; July 4, 1919 (substituted for notification in the *Gazette* of June 24, 1919).

Sec. Lieut. (Hon. Lieut.) A. S. Walker (Lieut., N. Lan. R., T.F.) relinquishes his commn. on account of ill-health (caused by wounds), and is permitted to retain the rank of Lieut.; Jan. 8.

Sec. Lieut. F. V. Wright, D.C.M. (Sec. Lieut., Ex. Reg. Employed List), resigns his commn.; Jan. 24.

The initials of Maj. J. P. Elsden are as now described, and not as stated in the *Gazette* of April 1, 1919.

The surname of Sec. Lieut. (Hon. Lieut.) D. R. Chalmers-Hunt is as now described, and not as stated in the *Gazette* of April 8, 1919.

The surname of Sec. Lieut. G. T. Kitto is as now described, and not as stated in the *Gazette* of April 25, 1919.

The notification in the *Gazette* of Dec. 2, 1919, concerning Sec. Lieut. (Hon. Lieut.) J. L. Bicknell is cancelled.

Medical Branch

(One officer transfd. to the Unemployed List.)

The initials of Capt. C. S. Glegg are as now described, and not as stated in the *Gazette* of April 4, 1919.

Memoranda

(Then follow the names of three overseas cadets granted temp. commns., and four cadets granted hon. commns. as Sec. Lieuts.)

Sqdn. Ldr. (actg. Wing-Comdr.) A. H. C. Kearsey, D.S.O., O.B.E. (Maj. 10th Hussars), relinquishes his temp. R.A.F. commn. on return to Army duty; Jan. 23.

Maj. R. E. Childers, D.S.C., relinquishes his commn. on ceasing to be employed, and is permitted to retain his rank; March 10, 1919.

The following temp. Hon. Lieuts. relinquish their commns. on ceasing to be employed:—F. Baron, J. Dixon, A. Johnson; Sept. 16, 1919).

(One officer transfd. to the Unemployed List.

London Gazette, January 27

The following temporary appointment is made:—

Staff Officer, 3rd Class (Air.).—Flight-Lieut. R. E. H. Daniel; Jan. 15.

Flying Branch

Capt. L. P. Paine, D.S.O., to be actg. Maj. while employed as Maj. (S.), without pay and allowances of that rank; May 1, 1919.

Capt. B. G. M. F. Nixon to be Capt. (O.) from (Ad.); July 10, 1918.

Flight-Lieut. H. V. German to be Flight-Lieut. (A. and S.), from (S.O.) Jan. 8.

The following Lieuts. are graded for purposes of pay and allowances as Capts. while employed as Capts. (A.):—A. Boyle, M.C., A.F.C., from May 1 to May 19, 1919; A. Boyle, M.C., A.F.C., from June 9, 1919, to Sept. 1, 1919; J. Palmer, from May 1, 1919, to Aug. 19, 1919.

Second Lieutenants to be Lieutenants:—S. H. Potter; March 26, 1919 (since granted short service commn.); H. W. Ogg; May 1, 1919 (since demobilised). W. H. Cox; May 30, 1919 (since relinquished commn.). C. A. Crichton; June 20, 1919. E. S. B. Clarke (since granted permanent commn.), A. E. Sharp; July 5, 1919.

Pilot Officer G. M. Trundle to be Flying Officer (A.); Aug. 7, 1919.

Pilot Officer L. J. Chandler to be Obs. Officer; Oct. 1, 1919 (substituted for notification in *Gazette* Nov. 7, 1919).

Sec. Lieut. S. F. Coleman to be Sec. Lieut. (A'ship), from (T.); April 1, 1918.

Cdt. L. L. Richard is granted a temp. commn. as Sec. Lieut. (A.); Sept. 19, 1918 (substituted for notification in *Gazette* Oct. 29, 1918, wherein this cadet was described as Richard Leo Lefebvre).

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Flying Officer A. S. Bourinot (Lieut., Quebec R.); Jan. 4, 1919. Flying Officer C. Smythe, M.C. (Lieut., Can. F. Art.); March 9, 1919. Flying Officer S. A. Hustwitt (Lieut., Can. Eng.); March 31, 1919. Pilot Officer (Hon. Flying Officer) W. Morrison (Lieut., Manitoba R.); March 24, 1919. Flying Officer H. A. S. Molyneux, D.F.C. (Lieut. (actg. Capt.) C. Ont. R.); March 28, 1919. Flying Officer W. R. Cooke (Lieut., Can. M.G.C.); March 31, 1919. Pilot Officer (Hon. Flying Officer) F. A. Markham (Lieut., R. Lancaster R.); Sept. 16, 1919. Wing Comdr. R. M. Rodwell, A.F.C. (Capt. W. York. R); Dec. 31, 1919. Flying Officer W. R. Oulton, A.F.C. (Lieut., Ches. R.); Jan. 3. Flying Officer R. S. L. D. Boote (Lieut., R.G.A.); Jan. 9. Flying Officer M. W. Greenhow (Lieut., York. R.); Jan. 13. Flight-Lieut. R. L. Chidlaw-Roberts, M.C. (Lieut., Hamps. R.); Jan. 16. Flying Officer L. A. G. Dalziel (Lieut. (Temp. Capt.) R. Scots. Fus.); Jan. 17. Flying Officer V. G. Southern, M.C. (Lieut., York. and Lancs. R.); Jan. 20. Flying Officer (Hon. Flight Lieut.) A. F. Hordern (Capt., S. Staffs. R.); Jan. 22.

The following relinquish their commns. on ceasing to be employed, and are permitted to retain their rank:—Lieut. J. M. Dillon; Feb. 20, 1919. Sec. Lieut. R. Baird; March 22, 1919. Sec. Lieut. (Hon. Lieut.) R. S. Cole, June 20, 1919.

(Then follow the names of 106 officers who are transfd. to the Unemployed List under various dates.)

Capt. R. M. Charley, M.C., relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Dec. 10, 1919).

The following Lieuts. relinquish their commns. on account of ill-health and are permitted to retain their rank:—J. S. Sherren (contracted on active service); Dec. 2, 1919. A. M. Motherwell (contracted on active service); H. L. H. Tate (caused by wounds); Jan. 20. Lieut. W. T. Barnes, D.F.C. (Lieut., R. Fus.), resigns his commn.; Jan. 28.

The surname of Sec. Lieut. L. L. Richard is as now described, and not R. L. Lefebvre, as stated in *Gazette* Jan. 6.

The initials of Lieut. B. W. Fletcher are as now described, and not as in *Gazette* May 20, 1919.

The notification in *Gazette* Feb. 28, 1919, concerning Lieut. J. M. Dillon is cancelled.

The notification in *Gazette* March 7, 1919, concerning Sec. Lieut. T. E. W. Browne is cancelled (notification in *Gazette* April 1, 1919, to stand).

The notification in *Gazette* May 23, 1919, concerning Sec. Lieut. J. C. Crook is cancelled.

Aviation in Australia

WITH the object of running an inter-state passenger and goods service, an aviation company with a capital of £700,000 is being formed in Melbourne.

Captain Matthews' Flight

ON his arrival at Baghdad, Captain Matthews said that, after leaving Vienna, he had to fight bad weather, and was taken prisoner by the Jugo-Slavs, who, believing him to be a Bolshevik, took his papers. Four days later, however, he got up very early, recovered his papers, and made for his aeroplane, the engine of which started immediately, in spite of its having been exposed to the intense cold.

Captain Matthews was detained for a month in Belgrade by snow, and while in Constantinople, he had to mend a cracked cylinder. He was held up in Aleppo for a week by continuous rain.

Another French Lady Pilot.

FRANCE now boasts another aviatrice, Mme. Adrienne Bolland who, observed by an official of the Aero Club of France, passed the necessary tests to qualify for a pilot's certificate on a Caudron G 3 at Crotoy on January 26.

Bombing Work in Morocco

IT was reported from the French Moroccan headquarters last week that a squadron of aeroplanes had bombed some encampments of the Tadla tribe, dispersing many insurgents, who left 20 dead.

The Flight to Timbuctoo

OF the three machines which left Paris to fly to Timbu too, only one, piloted by Major Vuillemin, succeeded in getting across the Mediterranean, the other two only reaching Istres in the south of France, Major Vuillemin flew from Barcelona to Algiers in 3 hrs. 20 mins.

French Prizes Awarded

THE following awards have been made by the Aero Club of France:—

Prize of 7,000 fr. and the cup presented by the French Aeronautical League—Lucien Bossoutrot, for his non-stop flight from Paris to Casablanca with seven passengers on the Farman Goliath, on August, 11 1919.

Height Record (pilot and two passengers), on December 20, 1919, at Villa Coublay—Henri Roget, 5,890 mètres (19,319 ft.).

Henry Deutsch Cup (Provisional award)—Sadi Lecointe, for covering the stipulated circuit at a speed of 266 kilomètres 314 mètres (165 1·3 miles) in an hour on a Nieuport-Hispano on January 3 last.

Poulet Back in France

IN spite of statements to the contrary, it appears that Poulet did arrive at Marseilles on January 28th. He only heard that a new machine was on the way to him when he reached Port Said, and then he was not allowed to return to Rangoon from there. He is, however, at once going back to Burma in order to continue the flight to Australia on the new machine.

Bombs for Whales

THE Breton fisher-folk round the Camaret coast and Cape Finisterre, who look to the sardine to provide them with their livelihood, have been so much worried by the depredations of a large number of whales, that they have at last petitioned the Under-Secretary of State to send them a seaplane with a supply of powerful bombs. But the remedy may prove worse than the disease.

The Rome-Tokyo Flight

ALTHOUGH the departure of the five aeroplanes which are to take part in the Rome-Tokyo flight has been delayed, in the hope that d'Annunzio might be able to lead them, it appears from his letter to Colonel Berliri, Director-General of Aeronautics, that he will not take part in "this thrilling adventure." He has selected Captain Gartinetti, who was one of the aviators who flew over Vienna during the war, who is now at Fiume, to take his place. The three other pilots selected are Lieutenants Bylisco, Angilotto, and Ferrarini.

The Caproni machine, piloted by Lieutenants Abba and Garrone, had been destroyed by fire when landing at Salonika, and the scouting machine on the Rome-Tokyo flight left Aleppo on the 21st inst., at 10 o'clock for Baghdad.

Aviation in Scandinavia

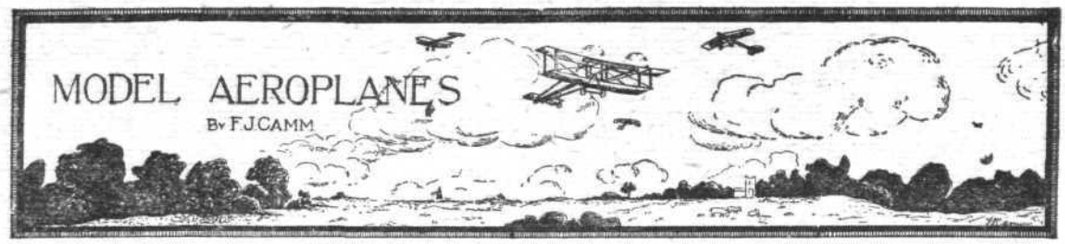
FOLLOWING on the conference which was held in Copenhagen, on the initiative of Switzerland a week or so back, it is stated that a detailed draft agreement on aerial traffic was drawn up at another conference of representatives of Denmark, Sweden, Norway, and Finland, held a few days ago in the Danish capital.

Air Navigation on the Continent

ACCORDING to the *Berlingske Tidende*, directors of British Danish, Dutch, Swedish, and German aerial navigation companies recently held a meeting in Copenhagen and discussed the air routes which it is proposed to establish when conditions permit.

Aerial Services in Peru

IT is reported, writes *The Times* correspondent at Lima, that Messrs. Vickers are negotiating for the establishment of a regular aviation service between Payta (on the Peruvian coast) and Iquitos (on the frontier of Ecuador, and some 600 miles from Payta), to become effective before the end of the year.



NOTE.—*All communications should be addressed to the Model Editor.*

Hints on Flying Model Aeroplanes

IN order that the machine will do a straight flight, the planes must be carefully aligned. To do this, hold the model by the propeller cross-bar with both hands up to the eye, and see if the cross-bar, back plane struts and front plane strut tips are in alignment with one another. If they are not, it will result in the machine being out of balance laterally, which will cause it to make sharp circles and to dive.

For circular flights, place the planes slightly out of alignment with one another.

The maximum number of turns to which each propeller may be wound with safety should be applied *only after they have been wound several times to a less number*. Winding to a greater number is liable to tire the elastic rapidly.

When a strand in one of the motors breaks, overlap the two ends, stretch and bind them with strong thread. Examine the elastic before flying the model, and search for a join in it, which will be found to be bound in this manner.

For a first trial flight, and to accurately adjust the model, wind only about 250 turns on each propeller.

The propellers must be wound outwards, curved surface first.

Be careful *always* to wind the propellers each an equal number of turns when the machine has twin screws.

When wound, hold the machine with one hand just behind the deepest part of the fin, and hold the two propellers with the other slightly above the level of the head, let go the propellers and then quickly launch the machine forward (as if throwing a dart) being careful to give it a good push and to send it *horizontal* and *not* up or down.

Until very skilled, *always* launch the machine straight against the wind (if any), and choose a calm day for the first experiments.

When in skilled hands, the machine can be flown in almost any wind.

Choose a good open space in which to fly the model. Remember that it flies for more than a quarter of a mile when fully wound.

If the model is properly adjusted, it should glide for a considerable distance when launched briskly and *very slightly downwards* by hand, coming to earth without any shock or bump.

If, in flight, the machine appears to rise and dive alternately (following an undulating path through the air), it shows that the front plane should be screwed down a little. The explanation of this is that the front plane, having too much "lift," causes the machine to rise too rapidly for its own power. It, therefore, soon shows up, and in order to recover the speed at which its planes sustain it in the air, it dives automatically, attains the necessary speed and then rises again, owing to the same cause. The machine when correctly adjusted should leave the hand quite horizontal, then, when a few yards away should rise very rapidly to a height of about 70 ft., at which height it should remain, perfectly steady, until the speed of the propellers is perceptibly lessened, when it should glide gradually down to the ground.

If the machine, after leaving the hand, dives straight for the ground, the front plane will require *raising* a little, as it will not be "lifting" sufficiently. Remember always to send the model off at a good speed. A perfect launch is at the "flying speed" of the machine, which is about 20 m.p.h.

Before each flight see that the boom is perfectly straight, and that the plane struts are correct. They can both be bent straight by hand very easily.

(To be continued.)

The Aero Models and Research Club

We have received the following letter from Mr. Burchell of the Aero Models and Research Club :—

"The club proposes to open its 1920 season during the Easter holidays, and it is hoped that a number of newly-designed models will be ready for this opportunity of putting them through their tests. There will be an exhibition of parachute descents from models in flight, which should prove interesting. Mr. White is expected to be on the flying ground during the meeting, and any aero modellist who may have seen his photographs will appreciate his value to the club in getting snaps of machines in flight. During the meetings it is proposed to hold various competitions, provided there are sufficient entrants. The prizes will consist of a model and parts presented by Mr. Burchell and Mr. Coleman. If circumstances should warrant, the club will also offer a prize for the best total of six flights during the Easter flying. Times will be published later.

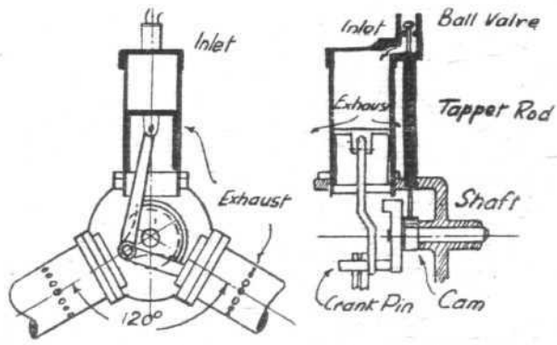
"It may be of interest to some of your readers to know that in the research department Mr. Coleman, with the assistance of Mr. Burchell, has been working on power plants for models, including electric with a special kind of cell, and should it prove successful, details will be published.

"Any modellist wishing to partake in the Easter flying will be most cordially welcome, and any further enquiries to the following addresses will receive our best attention :—

"The Aero Models and Research Club, late the Finsbury Park and District. Secretary, Mr. Burchell, 63, Belmont Street, Kentish Town ; Assistant Secretary, Mr. Coleman, 30, Hanley Road, Finsbury Park, N. 4. Flying ground, Parliament Hill Fields."

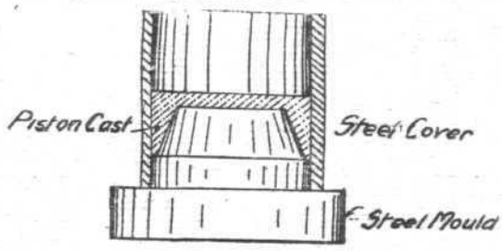
Aston Type Compressed Air Engine

Below I show a three-cylindered compressed air engine made on lines suggested by W. G. Aston several years ago. The cylinders are sweated on to flanges on the crank-case. Inlet



Aston Type C-A Motor

is operated by means of a ball valve operated by a tappet-rod and cam. The stroke is $\frac{5}{8}$ in., and the bore $\frac{1}{2}$ in. ; total weight $1\frac{3}{4}$ ozs. The engine is, of course, stationary ; exhaust taking place through ports drilled in the cylinder. The pistons are castings, of aluminium or brass, and are made as seen in sketch, showing a mould turned in steel. The brass



Casting Pistons

is melted and poured in, the top of the piston being cleaned up if necessary. The conical portion of the male mould should, of course, be made to the desired internal shape of the piston, and a hole should be drilled in its centre to form a lug on the casting, the lug in turn forming a bearing for the gudgeon-pin and connecting-rod.

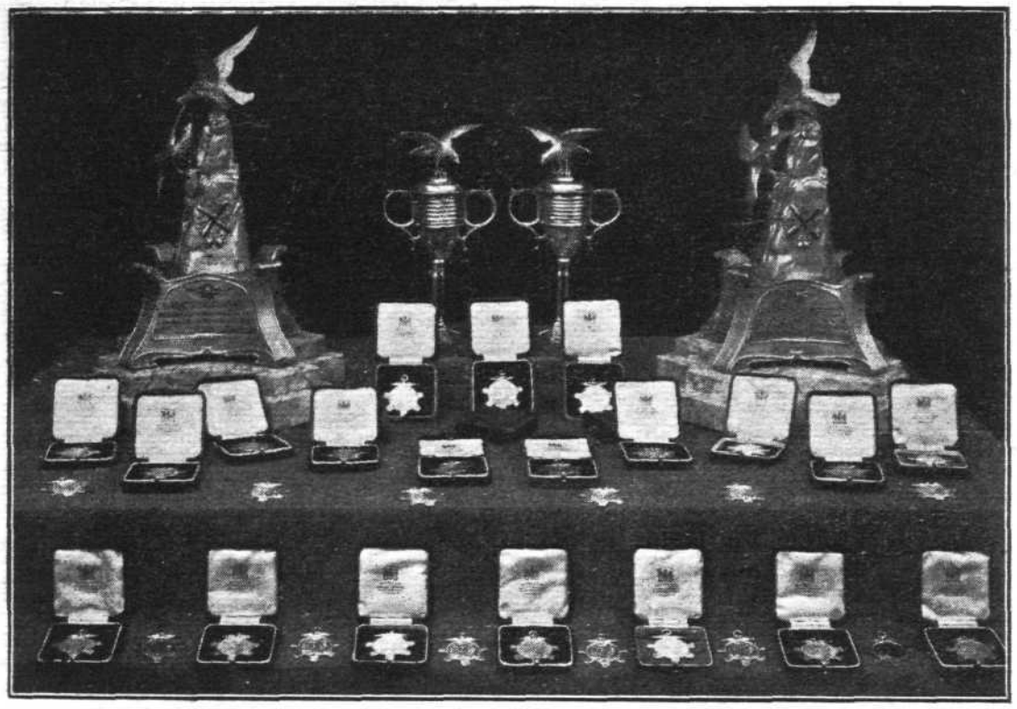
Replies to Correspondence

CONSTANT READER (No address).—Your question is too vague. Cannot you give more lucid details as to your requirements ?

J. C. H. G. (Cardiff) and R. W. (Bournemouth).—We replied direct.

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

SIDE-WINDS



Sir Charles C. Wakefield has always been a consistent supporter of the best boxing traditions. Added to this, Sir Charles is one of those who have undisguised admiration for the R.A.F. Combining the two, this little display of trophies and medals gives substantial proof of how Sir Charles has materially backed up his views, the trophies, cups and medals having been presented by him for boxing competitions amongst officers and men of the R.A.F.

ON January 27 a most interesting programme of music, including Sterndale Bennett's "The May Queen," was rendered by the Sopwith Choral Society, the concert taking place in the firm's own entertainment room. Under the direction of Mr. Alan Fenn who acted as conductor—he had organised and trained the choir from the beginning—the evening was a triumphant success, and reflected the greatest credit upon all concerned. It also affords an admirable example of how, in a progressive firm, the good feeling that should exist between employers and employed, can be stimulated and maintained by common interests. All the vocalists, including soloists, are employed in the manufacture of A.B.C. motor cycles at the works of the Sopwith Aviation and Engineering Co., Ltd.

MR. LOUIS NOEL has recently been on a short visit to London, where he renewed acquaintance with many old friends at the Royal Aero Club and at Hendon. He appears to have given up his interest in flying, being actively engaged in other business in Roumania. He has a wide knowledge of affairs in the East, and spent a great part of his time during the War in that part of Europe.

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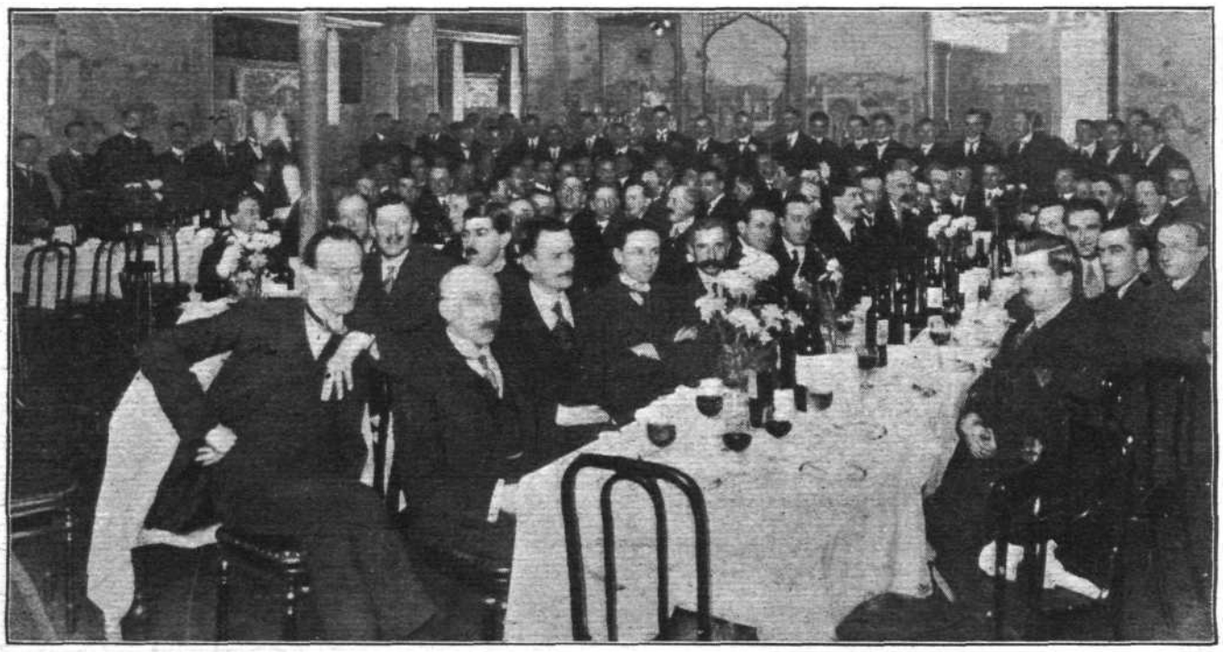
MR. JULLEROT, who will be remembered by many for his connection with the first Bristol flying school and his many experiences in various parts of the world at a time when flying was really new, is now back in London recovering from a serious accident. Mr. Jullerot, who has for some time past been associated with the Aviation Department of Messrs.



THE NAPIER ANNUAL STAFF DINNER : A little function which seems to grow in enjoyability just as steadily as the number of diners mounts-up, year by year, is the Annual Dinner of the staff of D. Napier and Son, Ltd. Held on January 16 last, the 1920 gathering gave insight as to the method by which Napiers cut-out unrest—simply by doing everything possible to foster the best of good fellowship between the directors, managers, superintendents and workers.

Vickers, was on board the Ostend boat which met with such terrible weather recently, and it was only by the greatest effort that he managed to hold his wife and himself in safety. In doing so he had three ribs broken and injured his leg, while Mrs. Jullerot also sustained an injured leg. By a sad coincidence his brother-in-law was drowned the same day in the tragic wreck of the *Afrique*, the French liner which went down with over 500 persons. The sympathies of his many friends will be extended to Mr. Jullerot on this bereavement and on his own unlucky experiences.

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IT is an axiom that Coan casts clean crank-cases, but it may not be known so generally that Coan champions charming Clacton. Little wonder, therefore, the wise ones of that sunny borough have elected Mr. C. C. C. Coan to the, amongst other prominent local positions, Presidentship of their Advancement Association. Last week Mr. Coan more than justified their choice when he took the chair at the Grand Hotel at a very remarkable gathering of the town-folk supported by a goodly number of prominent London men, to give a post-War restart to the Association in its efforts to let the attractions of sunny Clacton be more generally known, and thereby afford those in search of health a chance of appreciating one of the finest health tonics in the world. No resort in England could probably surpass, and very few could equal, the wonderful and invigorating air of Clacton-on-Sea. It is life itself. And in the Clacton of today, with its winter gardens and band-stand arrangements, it would be difficult to name a more delightful end to the objective of a week-end run, whether it be spring, summer, autumn or winter. With the Grand Hotel to put up at and to be welcomed by genial host Mr. Harry Grant, is an experience in itself. This fact must have been evident to the many visitors who joined in the gathering presided over by Mr. Coan. Fortunately Sir H. W. Thornton, the very live chief of the Great Eastern Railway, was able to be present, and he was so favourably impressed that he pledged himself to specially consider the just claims of the Clacton Advertisement Association to improve even still more the generous railway service which it is found possible to run, even through the winter months. So we wish Mr. Coan and his honorary co-workers well in their efforts. So kindly and thoughtful a manufacturer as C. C. C. Coan is not encountered every day of the week. And so it comes about that the exhilaration of the Clacton air has so established the sound health of C. C. C. C. and his'n that he must needs extend the benefits to his employees, by establishing shortly in the district a branch of his well-known foundry, thereby giving his men both employment and something worth living for.

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Recent Developments in Aviation

THE next lecture in the series, arranged by the London County Council for teachers, on "Recent Developments in Science," will be by Mr. F. Handley Page, C.B.E. It will be given at King's College, Strand, W.C. 2, on Saturday, February 28, 1920, at 11 a.m., and the chair will be taken by Sir Arthur Duckham, K.C.B., M.I.C.E.

H.P. London–Paris and Brussels Air Services

ON the Handley Page London-Paris and Brussels Air Services between September 2, 1919, and January 29, 1920, 924 passengers and 43,412 lbs. of freight have been carried over a distance of 65,293 miles.

H.P. W. 8 Flies from Paris

ON January 22, the new model Handley Page commercial aeroplane, Type W. 8, which was exhibited in the recent Paris Salon, returned to London by way of the air. In flying to and from the Exhibition, it accomplished an unique performance, as, we understand, it had only carried out one short test flight of 20 minutes before it made its flight to Paris in 2 hrs. 10 min.

British Aviators in Warsaw

ACCORDING to the Polish information Committee, the Handley Page aeroplane newly arrived in Warsaw by air, in response to an invitation from the Polish National Aeronautic Society, has been making exhibition flights in the presence of the Ministers and diplomats. After the flights the British aviators, Captains Herne and McNaught Davis, and Lieutenants Wilcox and Capps, the special representative of the Handley Page firm, Mr. Richard, and the members of the organising committee of the Polish National Aeronautic Society, were entertained to dinner at the officers' mess in the military flying headquarters by the Inspector-General of the Army Air Forces. The British Minister was present at the dinner, during which speeches were made noting the friendly relations between Poland and Great Britain. The British flying men were presented by General Macewicz with the distinctive decorations of the Polish Air Forces.

COMPANY MATTERS

Mann, Egerton and Co., Ltd.

THE report of Mann, Egerton and Co. for the year ended September 30, 1919, states that the net profits, after charging all interest on loans, debentures, etc., and after making provision for depreciations and for doubtful debts, but before making any allowance for excess profits duty, amount to £56,170, which, with the sum brought forward, £11,265, less interim dividend on preference shares, £3,133, makes a total of £64,302. The directors recommend a dividend of 40 per cent. on 30,000 ordinary shares, carrying forward, subject to excess profits duty, £48,684. Since the close of the financial year the share capital has been reorganised, and the company has been converted from a private to a public company. Additional ordinary shares to the nominal amount of £30,000 were issued as a bonus out of the reserves, and an issue of 8 per cent. cumulative preference shares was made to the public in December last and was over-applied for.

NEW COMPANY REGISTERED

KNIGHT AND KENDALL, LTD., 134, High Road, New Southgate, N.—Capital £10,000, in £1 shares. Ironfounders, engineers, manufacturers of and dealers in sea and air planes and parts thereof and motor cars, etc. First directors: J. S. Knight, J. P. Kendall, A. H. Smith, Dr. A. S. Ransome, H. Hudson, Capt. E. Lasson and F. W. Briggs.

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AERONAUTICAL PATENTS PUBLISHED

Abbreviations:—cyl. = cylinder; I.C. = internal combustion; m. = motors

APPLIED FOR IN 1916

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published February 5, 1920

13,188. SOC. ANON. ASTRA. Valves for balloons. (101,488.)

APPLIED FOR IN 1918

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published February 5, 1920

4,688. C. J. H. M. KENNEDY and T. W. K. CLARKE. Tail planes. (137,341.)

APPLIED FOR IN 1919

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published February 5, 1920

4,280. S. E. SAUNDERS. Interplane struts. (137,411.)
5,506. A. BETTICA. Multiple bomb for aeroplanes. (133,936.)
6,462. E. E. SMITH. Parachutes. (137,429.)
9,173. S. J. GAMMELL. Method of assisting pilots to alight. (137,445.)
21,033. R. J. L. MOINEAU. Landing-carriages. (133,294.)

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